

## COLOUR IN WOVEN DESIGN.





# COLOUR IN WOVEN DESIGN

BEING A TREATISE ON  
THE SCIENCE AND TECHNOLOGY OF TEXTILE COLOURING  
(WOOLLEN, WORSTED, COTTON AND SILK MATERIALS)

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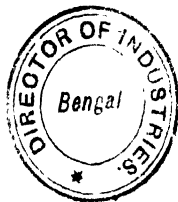
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EDITOR OF

"THE JOURNAL OF THE LEEDS UNIVERSITY TEXTILE STUDENTS' ASSOCIATION"

WITH 39 COLOURED PLATES, CONTAINING 187 ILLUSTRATIONS  
AND 280 FIGURES IN THE TEXT

SECOND EDITION, REWRITTEN AND ENLARGED,  
WITH NUMEROUS ADDITIONAL ORIGINAL ILLUSTRATIONS



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THIS NEW AND ENLARGED EDITION  
IS DEDICATED TO THE MEMORY OF MY LATE FATHER

JOHN BEAUMONT,  
PROFESSOR OF TEXTILE INDUSTRIES  
THE YORKSHIRE COLLEGE, LEEDS,  
1875-1889.





## PREFACE TO FIRST EDITION.

THREE years ago the first edition of my work on *Woollen and Worsted Cloth Manufacture* appeared, and in the preface of the book I observed that should it be satisfactorily appreciated I would write other treatises on specific branches of textile designing and weaving.

Partially in fulfilment of this promise, and partially because I have frequently been requested by designers, manufacturers, and students who have attended my lectures on textile colouring at Leeds, Huddersfield, and other places, to prepare a text-book on the application of colours to woven fabrics, this volume has been written, which, to use the hackneyed prefatory phrase, is *intended to meet a long-felt want*.

Though there are several useful works on Colour—to wit, those of Chevreul, Rood, Benson, Hay, Field, Maxwell, and Guichard—dealing with its scientific phases, yet they can scarcely be said to lend that kind of help to the student of applied design that is needed; hence the necessity of this handbook, which is the first treatise published professing to treat exclusively of the colouring of woven styles.

During the last fifteen years various efforts have been made to teach textile designing and manufacturing systematically, and to specify the principles which underlie the origination of pattern in the loom: what to some extent was, previously, haphazard work, inasmuch as there were no schools for teaching textile technology, and those apprenticed in the mill were

generally allowed to glean information as best they could, has now become an exact science. Colouring, however, though practically of primary importance in design, has not been so efficiently taught as some branches of textile manufacturing. The object of this book is, therefore, to supply as far as possible a complete scheme of textile colouring, and to demonstrate the methods of applying fancy shades to all descriptions of woven manufactures.

Referring briefly to the plan of the book: In the early chapters the pigment and light theories of colour are expounded, and also the attributes and qualities of colours, and the laws of contrast and harmony. Subsequently, the technicalities characterizing woven colour combinations are analyzed *in extenso*.

As the initiatory method of introducing tints and shades into fabrics consists in blending raw materials of divers colours, the art of mixing to obtain artistic mingled compositions is at the outset fully considered. This part of the subject is possibly of the first importance to those engaged in designing fancy tweeds and kindred classes of woollen goods.

After having treated of the combination of shades in "blending," reference is made to the principles of developing simple patterns by amalgamating warp and weft yarns. The various kinds of stripe, check, mixture, and figured effects, and the tinting of all types of single, backed, and double cloths, of combination patterns, of fabrics figured in the warp, in the weft, and in both warp and weft, are all treated of at length. Woollen, worsted, cotton, and silk fabrics, and the specific styles of colouring applicable to each, have also obtained detailed notice.

Many of the patterns printed on the plates have been woven at the Yorkshire College under my supervision, and are now published for the first time; while the other figures, with the exception of a small number appearing in the *Textile Recorder*

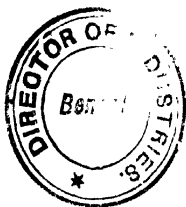
*PREFACE TO FIRST EDITION.*

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in articles I have written for that journal, and which the Editor has kindly permitted me to use, have been specially prepared for this book. It need scarcely be observed that the coloured illustrations are unique, being exact representations of the woven textures.

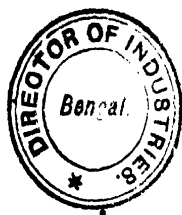
I have pleasure in acknowledging my indebtedness to my publishers, who have done all in their power to meet my wishes in the execution of the plates of woven samples.

R. B.









## PREFACE TO SECOND EDITION.

THIS Work has been rewritten and enlarged. Numerous original illustrations have been added in the text and also to the coloured plates, which should enhance its value to the Textile Colourist, whether Student or Expert.

A chapter has also been prepared on Colour Standardization, the scheme for which has been originated and developed in the Textile Industries Department of the Leeds University, under my supervision and in collaboration with Mr Thos. Hollis, Lecturer in Yarn Manufacture.

In reading the proof sheets, I acknowledge the help of Miss Clara Benton, of the Clothworkers' Museum of the University.

I am indebted to my Publishers for the regard and consideration they have had to my wishes in the preparation of the Book.

R. B.

UNIVERSITY OF LEEDS,  
1911.



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# COLOUR IN WOVEN DESIGN.

## CHAPTER I.

### THEORIES OF COLOUR.

1. Elements of Woven Pattern—2. Occurrence and Utility of Colour in Loom Productions—3. Treatment of Colour in Relation to Textiles—4. Methods of Using Colours in Textiles—5. Colour Phenomena—6. Analysis of Light—7. Utility of Prismatic Experiments—8. Schemes of Colouring—9. Primary Colours—10. Compound Colours—11. The Three Constants of Colour—12. Temperature of Colours.

1. *Elements of Woven Pattern.*—Weave, compounds of form, and blending of colour are the three primary elements of textile design. They enter, either separately or in combination, into the many styles of loom effects. Weave relates specifically to the build or structure of the fabric, and is a necessary factor in any type of texture, whether plain, twilled, or ornamental in character. It is the scheme or plan of crossing the warp and weft yarns that forms or produces the fabric. Weave may give a compact texture subordinate in effect to other elements in the design; or, it may be the constructive and not the ornamental part of the pattern; yet in several woven specimens it possesses both these qualities. Fabrics of this description are not embellished with compounds of form or colour, and hence derive their design from the structural plan employed in the operation of weaving. Schemes of intertexture giving these results are devised in such a manner as to form, by interlacing warp and weft, an even fabric, decorated with a type of pattern consisting of minute effects in threads or yarns, and which may be subdued or decided in definition.



Fig. 1 is an elementary type of Weave design or Pattern. The weave used is fig. 1A. The sections are produced thus:—

A. White warp crossed with white weft.

B. Grey       "       "       "       "

C. White     "       "       black   "

D. Grey       "       "       "       "

Four degrees of definition of the design are present. The textural effect is clearly visible in section A, but increasingly distinct in sections B, C, and D, due to the improved or more

FIG. 1.

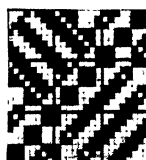
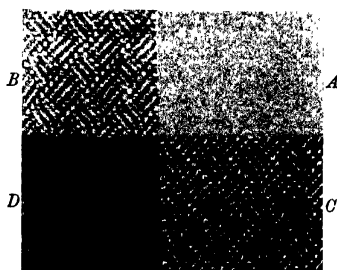


FIG. 1A.

pronounced contrasts of the shades of warp and weft combined.

Briefly considered, Weave has the following functions in textile design:—

- (1) In the construction or build of the fabric.
- (2) In the development of textural design (fig. 1).
- (3) In the production of special and compound makes of fabrics.
- (4) It is employed to accentuate or subdue in simple and decorative styles certain parts of the design—producing harmony of composition, whether due to blends of form, colour, or both.

Combinations of form have no relation whatever to the

structural arrangement of the fabric. The sphere of form in woven design is not constructive or utilitarian, but in the amplest sense ornamental. It is surface decoration obtained by amalgamating, on definite principles, linear and curvilinear lines: ornament, consisting of geometrical or floral features, is applied to such loom products as dress, mantle, and vesting fabrics; silk textures, including neckties, handkerchiefs, robes, and decorative styles; damasks, quiltings, tapestries, etc.; carpets, hand-woven or tufted (produced on the vertical loom and now made in Donegal and some parts of Scotland as well as in the East); velvet, or cut pile (Axminster type); looped or uncut pile (Brussels type); and Kidderminster and other plain-surface productions.

Colour, the third characteristic in design, is differently related to textile effects from Weave and Form. The special function of colour is to impart brightness of tone and improve the qualities of the design. There are many varieties of pattern in fabrics for wear, which possess freshness owing to the style and method of colouring practised. In the woven decorative arts, colour may be the main constituent of the design, or employed to develop its integral parts.

2. *Occurrence and Utility of Colour in Loom Productions.*—

Colour is extensively used in woven design. It obtains, and is the prevailing element of the pattern, in all classes of fancy woollens, such as tweeds, flannels, and light textures, and thick figured rugs, wraps, and shawls. Whether the pattern be stripe, check, figure, or intermingled effect, it obtains its outline and detail from the method of colouring adopted. But colour is not confined to woollens; it is also an important factor in design produced in worsted, silk, cotton, jute, ramie, and other yarns. There is, in worsteds, a larger diversity of weave design than in woollen or carded-yarn textures; but, still, colour is very extensively employed to develop the effects due to weave and form, and also to impart a cheerful and lustrous appearance to the cloths. Patterns in dress fabrics, shirtings and blouses, made entirely of cotton, are frequently combinations of fancy shades; while, if the fabrics composed of silk and jute materials are considered, including—in silk—ties, handkerchiefs,

and various kinds of matelasses; and—in jute—simple carpets, mats, and coarse rugs, it will be discovered that the colour element of the design largely predominates. This brief summary of the textures, in which fancy shades are used, shows that colouring, and the combinations of colours, in all branches of woven products embellished with design, are the elements which give tone and character to the styles. Though the fabrics produced may be soft to the touch, substantially made, uniform in structure, and skilfully finished, yet a lack of brightness and harmony of colouring so powerfully detracts from the merit of the pattern, that these qualities, in themselves, are not sufficient to give the fabric an attractive appearance—particulars which demonstrate the importance of choice and tasteful colouring in designs produced in the loom. Evidently colour is of twofold utility in the development of woven effects; for it may, firstly, be the sole constituent of the pattern; and, secondly, a supplementary element which affords precision and beauty to the composition of the design.

3. *Treatment of Colour in Relation to Textiles.*—Though, to a considerable extent, the principles of colouring are, similar in all types of decorative design—harmonious blending and contrasting combinations possessing like qualities in whatever materials they obtain—still there are several reasons why some of the recognized canons of the science of colour are inappropriate, if not inapplicable, when textiles are the media of development. Foremost of these reasons are the technical difficulties which arise in the employment of colour in woven pattern. There is not the same facility nor means for its application here, as in the treatment of ordinary surface decoration. The make of the fabric, and the principles of its structure, determine the system of distribution; while the general aspect of the entire body of colouring varies according to the nature of the materials employed. If the same colourings which appear harmonious, neatly toned, and cheerful in arrangement in a velvet pile carpet, were reproduced in a silk texture, many points of dissimilarity would be noticed in the general effect obtained, though the tint and hue of the shades combined, might be identically the same in the respective fabrics. Why is this? Are not the apparent

modifications in the colourings—for such they appear when thus compared—due, first, to the difference in the nature of the materials composing the textures; second, to the dissimilitude of their structural character; and, third, to the distinct principles of weaving practised in their production? The pile of the carpet—dense and compact—gives breadth, force, and richness to the colours; whereas the fine and clear texture of the silk imparts a more precise effect to the shades, causing the whole blend to possess an aspect which, while harmonious, lacks that mellow quality of bloom so characteristic of the pile production. It is clear, therefore, that colour in textiles requires to be studied as a special art. Its functions and effects in woven fabrics are so various and distinct from what they are in ordinary decorative work, that it can only be effectively treated when the nature of textile materials, and the diverse structures of the fabrics, are considered. In a word, there are not only recognized principles of woven design which have no place in purely ornamental art, but also schemes and laws of colouring which simply apply to the development of pattern in textile fabrics. Any exposition, therefore, of the theory and practice of colouring, to be useful to the textile technologist, must be given in relation to the varied technicalities of the weaver's craft.

4. *Methods of Using Colours in Textiles.*—Colour is not always applied to woven textures on the same system. The method of utilization depends upon the composition of the design to be woven, and on the structure of the cloth it is intended to produce. There are fabrics in which the colour element is so decided that the effect obtained is somewhat similar to the results noticed in ordinary surface decoration. Take, for example, silk textures of a ribbon class, in which, by skilful workmanship and exact sketching, any floral form may be developed with a delicacy of toning and correctness of delineation that cannot be improved upon, even though the crayon or the brush should be employed. But this is not a common, because not a useful, species of designing and colouring. Carpets and tapestry fabrics illustrate other principles of employing fancy shades. The structure of some types of carpets very materially affects the character of the colourings. In Brussels and tapestry, for instance, the loop or

pile of the carpet which forms its distinguishing feature, prevents that solidity and compactness of colouring noticeable in the silk ribbon or dress material. If the same design and blend of shades introduced into a Kidderminster or Scotch carpet were subsequently applied to a Brussels production, they would be entirely changed in appearance; for there is no common principle of intertexture in the respective carpets. In cotton, silk, woollen, and worsted textures, colour is found to have a different tone or cast in each fabric. Fancy colours in cottons, while decidedly smart and clear in effect, are comparatively non-lustrous, raw, and dull in toning.<sup>1</sup> Silk is distinguishable by brilliance of hue; woollen colourings have a unique depth and saturation of hue characteristic of the material employed in their manufacture; while worsted colourings are bright, definite, and smart in appearance.

These differences are due to the physical formation and properties of the several fibres and yarns. Thus, a filament of silk is almost transparent, and shines like a smooth glass rod when light falls upon it; that of wool is solid and opaque in the centre, but its exterior consists of a multitude of semi-transparent scales, which, when of large dimensions and uniformly arranged—as in the best qualities of Lincoln and Leicester wools—reflect light with a minimum amount of dispersion, and impart to the woven material a lustrous aspect. Cotton has no such partially transparent surface. Its downy structure absorbs light freely, while what is reflected is so broken up, that the colour resultant is impoverished in saturation and brightness. To clearly apprehend the degree to which the nature of the raw material is capable of changing the tone or character of colours, compare three plain woven textures of the same colour made of silk, wool, and cotton respectively. Lustre, brilliance, and richness are the features of the silk colouring. Though thus bright, it lacks that fulness and depth of hue which appertains to the wool production, the filaments of which closely compounded, and all tinted alike, possess a peculiar bloom and saturation of colouring not to be found either in the silk or cotton. The cotton texture is somewhat dull and flat in quality of

<sup>1</sup> Mercerized cottons possess some of the qualities of silk colourings.

hue, lacking the brightness of silk. Such is the importance of the relation of the material to the species of coloured effect produced in textiles, that it will require subsequent analysis.

The various methods of employing fancy shades in patterns obtained in the loom may be briefly summarized as follows:—

TABLE I.

## METHODS OF APPLYING COLOUR TO TEXTILES.

- I. In mixture cloths, for suitings, coatings, and costumes.
  - a. { By combining or blending various colours of materials.
  - b. { By combining several classes of twist threads.
- II. In plain, twilled, mat, and fancy weave designs, for trouserings, coatings, suitings, dresses, costumes, flannels, shirtings, and fine textures.
  - a. { By applying colour to the warp, forming stripes.
  - b. { By applying colour to the weft, producing spotted patterns.
  - c. { By applying colour to both warp and weft, giving checks and other styles.
- III. In figured designs for dresses, mantlings, vestings, shawls, rugs, ~~mauds~~, carpets, and tapestries.
  - a. { By using one or several series of extra warp yarns.
  - b. { By using one or several series of extra weft yarns.
  - c. { By using one or several series of extra yarns in both warp and weft.

Each of these systems is capable of further subdivision; but, as here given, they represent the principles of colouring the general classes of woven designs.

5. *Colour Phenomena*.—Under ordinary conditions, light is essential to colour apprehension. Diversity of hue may be made evident to the mind by mechanical agitation of the optic nerves in a darkened room. Of course, such an experiment is only useful as showing the media by which colour sensations are rendered visible, or rather conveyed to the mind.

The colour of an object is determined by three things: the nature of light, the physical properties of the material on which

light falls, and the power of the observer's eye. These are obvious conditions. Change the light from brilliant daylight to gaslight, and a richly coloured fabric undergoes several modifications—the hues suffer in brightness and lose a measure of their co-relative value. Or, by using a mono-chromatic light (that from burning sodium is a compound of two yellow lights of similar quality in the spectrum<sup>1</sup>), coloured objects may be changed to a similar hue. That colour is affected by the nature of the material has been stated in reference to fibres of wool, cotton, and silk.

Incapacity to correctly distinguish the hues, tones, and tints

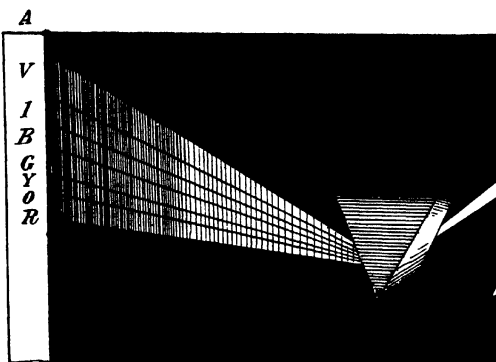


FIG. 2.

of colour is caused by some affection of the retina. Training and practice in the matching and blending of colours may enhance the acuteness of colour vision. The Gobelin tapestry-weaver will select, without hesitancy, from a bundle of bobbins of tints of material of the same hue or colour, the one he requires. Similarly, the carpet-weavers of Donegal — after a period of training — will unerringly manipulate a varied assortment of delicate colours.

"Light is due to waves — or other periodic disturbances, whose recurrence resembles that of waves — in the ether of space; and just as air-waves of a certain definite frequency of recurrence will induce in the ear the sensation of a sound of

<sup>1</sup> "Colour": *Chambers' Encyclopædia*.

a particular pitch, so will the impact of 'ether-waves' of a certain particular frequency induce in the eye a sensation of light of a particular colour."<sup>1</sup>

The extreme visible red in the spectrum is produced by 392 billions, and the extreme visible violet by 757 billions of waves per second. The table gives the wave frequency of the spectral colours :—

TABLE II.

## WAVE FREQUENCY OF THE SPECTRAL COLOURS.

Red . . . .	492.4 billions per second.		
Orange red . . . .	484.1	"	"
Orange . . . .	503.3	"	"
Orange yellow . . . .	511.2	"	"
Yellow . . . .	517.5	"	"
Green . . . .	570	"	"
Blue . . . .	591.4	"	"
Cyan blue . . . .	606	"	"
Blue . . . .	635.2	"	"
Violet blue . . . .	685.8	"	"
Puce violet . . . .	740.5	"	"

As the frequency of the vibrations increases, or as they are diminished in length, the visible colours of the spectrum are produced. Just as the pitch of a musical instrument depends upon the celerity of the wave it produces, so the colour of an object is subjective to the length of the undulations transmitted. This analogy between the phenomena of sound and light has led some colourists to attempt a scheme of colours based upon similar laws to musical harmony.<sup>2</sup>

6. *Analysis of Light*.—When a pencil of sunlight passes through a prism horizontally fixed, as in fig. 2, it is decomposed, and produces on the screen the colour spectrum A, Plate I. In the intervals between each hue there is a gradation to which the colours are severally susceptible. Red passes, through a diversity of tinting, into orange, which graduates into yellow; and green, green

<sup>1</sup> Abney's *Colour Measurement and Mixture*.

<sup>2</sup> Wilkinson's *Harmonious Colouring*.



blue, blue, indigo, and violet occur in succession, all softly toning into each other. The purity and intensity of each colour will be observed.

A second and useful experiment may be made as follows:—Place a piece of black cardboard, about an inch wide and a few inches in length, on a white ground, and view it through the edge of a prism. If this experiment be correctly made, a result will be obtained corresponding to *B*, Plate I. The edge nearest the observer produces the violet, blue, and green side of the spectrum, while the opposite edge gives red, orange, yellow, and pale yellow—these two series of spectrum colours of distinct qualities being divided by a narrow band of black.

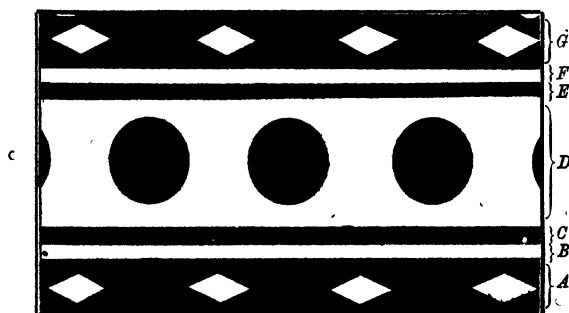
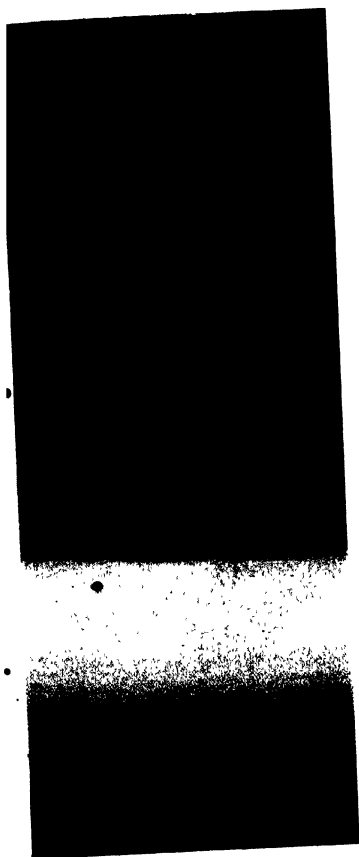
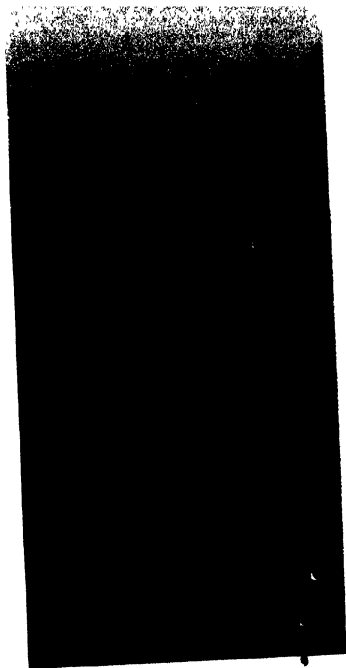


FIG. 3.

Coldness is the distinguishing characteristic of the violet side, and warmth that of the red side; in the upper portion of the spectrum are found the intense, ostentatious hues, while in the lower portion are the colours of a subdued, soft quality. Yellow and green are beautifully toned. The former passes from a yellowish orange into a pure, bright tint, which is softly shaded off into white. Green, on the front edge of the black line, is similarly graduated in hue, but as the band of this colour is not so broad as the yellow strip, its shadings are not so extensive; still, it imperceptibly changes from deep into pale green, and diminishes in intensity until it disappears in white light. One feature of this experiment will at once be observed, namely, the brilliance and richness of coloured lights, when compared with corresponding colours obtained by pigments or dye sub-



A



B

Plate I

A - SPECTRUM

B = SPECTRUM RESULTANT FROM VIEWING A STRIP OF BLACK  
ON A WHITE SURFACE THROUGH A PRISM



stances. Bloom, depth, and purity of hue characterize the former; but however the latter are produced, they seem, in comparison, to be lacking in fulness, intensity, and brightness.<sup>1</sup>

7. *Utility of Prismatic Experiments.*—Experiments with the prism afford suggestive exercises in colour blending. Seeing that the results of these experiments are richer by far than those obtained by pigments, and always harmonious in tone, they are calculated to enhance appreciation for pure and lustrous colouring. For the purpose of successful manipulation of prismatic experiments, and of viewing in a suitable manner the effects that may, by this means, be produced, a piece of black velvet or cloth should be employed, and patterns cut out of white cardboard placed on it, and then the design thus arranged examined through the prism. The more ingenuity exercised in pattern origination, the more pleasing the combinations resultant. Fig. 3 illustrates the class of designs adapted for this work. Form and arrangement should be of the most elementary kind, and the whole pattern clear and pronounced, in order to allow of a complete development of the colours formed on the respective edges of the various figures. Intermingled, diminutive patterns give confused and indistinct effects. On the other hand, broad and large designs yield lustrous colourings, which the experimenter may feasibly dissect, and which teach principles in colour arrangement, harmony, and contrast, of utility in pattern production.

When the pattern in fig. 3 is viewed through the refractory angle of a prism at a distance of about two feet, and about three times larger than here sketched, it forms an interesting assortment of colourings and tinted effects. Any description of this experiment, however concise and clear, can only afford a vague idea of the real appearance of the pattern when prismatically examined. Still, to assist the reader to make the experiment accurately himself, a detailed analysis is given. Treating of the different sections of the patterns, the edge of band A, nearest the observer, should be considered first, which commences with pure green, running through blue, purple, deep violet, and crimson. The crimson results from the violet

<sup>1</sup> Paterson's *Science of Colour Mixing*.

rays of this edge blending with the intense red rays of the further edge of band *A*.

**SMALL LINES *B* AND *C*.** The former begins with crimson, which successively changes into scarlet, orange, and yellow, a small strip of white separating these colours from those of band *C*, which consists of various tints of green and orange.

**DIAMOND FIGURES OF BAND *A*.** The front edges of these are tinted with scarlet, orange, and yellow, and the opposite edges with various shades of green.

**CIRCLES OF BAND *D*.** First, as to the edges nearest the observer. These are coloured with emerald-green and grass-green. It will be noticed that the green in this section of the pattern is distinct from that produced by the front edge of band *A*, being, as stated, more grass- than sea-green. Its peculiar tint results from the orange rays of the upper edge of band *C* intermingling with the green rays of the circles. As the centres of the circles are approached, green is succeeded by blue, purple, and black. Second, as to the distant edges of the circles. At these points red, crimson, scarlet, and orange—the latter colour graduating imperceptibly into yellow—all occur. It is notable that the yellow hue is somewhat dingy, being adulterated with other colours. Compare it, for example, with the yellow resulting from the extreme edge of this diagram. Its dulness and impurity are due to certain colours intermingling with it. Thus, the space between the extreme edge of the circles and band *E* is so limited, that the yellow rays of the circular objects combine with the green rays of the latter, and, as a consequence, the yellow suffers in purity and luminosity.

**BANDS *E*, *F*, AND THE FRONT EDGE OF *G*.** These, very closely resembling strips *B*, *C*, and *A*, require no description.

**EXTREME EDGE OF BAND *C*.** Here the red side of the spectrum is seen in its intensity and lustre; it begins with deep red, which gradually verges into orange, and the latter into yellow.

This simple experiment demonstrates the value of prismatic results. All colourists should study shade combinations through these media. Analysis of the colourings obtained in this manner increases the acuteness of the faculty of discrimination of the brilliance and depth of hue of individual colours. Though,

in practice, the textile designer has to deal exclusively with pigments and dye substances, yet the intensity and beauty of the combinations resulting from the decomposition of light are so novel and suggestive, that all desirous of cultivating aptitude for harmonious colourings will be at pains to multiply experiments of this class, which afford a true conception of what constitutes harmony and contrast in colours.

That such compounds of spectrum colours have an application to textile design is evident from the specimens on Plate II., in which tints of the pure or prismatic colours are used in silk fabrics. The mode of distribution is irregular, but this is done for the purpose of subduing the strength of contrast which would be formed if the colours were used on the basis of the experiment described. Two fabrics are given as examples on Plate II. No. 1, a silk ribbon, is produced by weaving in a bold warp rep or cord weave, the colours being arranged in the warp to give the intermingled shaded effect. The weft is a thick, yellow cotton yarn, but, owing to the weave structure, does not show on either the face or underside of the texture. In the second example, No. 2, the colouring is due to printing the warp prior to weaving. It has a similar intermingled composition, but the colour contrasts are harsher in tone. Both examples show the utility of prismatic colours in their purity, or when slightly subdued by tinting.

8. *Schemes of Colouring*.—There are two important theories of colour—the Light Theory and the Pigment Theory. The former deals with the phenomena of colours, the attributes of light, and the laws which control the modification of the intensity, hue, and tone of colours. These varied phenomena are theoretically of value, but as they have few practical applications, the pigment theory of colouring is necessarily adopted in the applied arts, and deals with colour as an active element in decorative design. Every possible shade and hue of colour may be obtained by mixing red, yellow, and blue in variable proportions, and, of course, by toning and tinting with white and black. Mixtures of lights and pigments, however, do not give analogous results. Lambert<sup>1</sup>

<sup>1</sup> Atkinson's *Ganot's Physics*; Tyndall's *Fragments of Science*.

is credited with being the first to discover and prove that the colours due to these two causes were rarely identical, and frequently widely dissimilar. His method of doing this consisted in using two coloured wafers, *A* and *B* (fig. 4), which were placed on a black surface, and a piece of ordinary glass, *g*, fixed vertically. It was found that when blue and yellow were thus simultaneously seen, the rays reflected by them did not, when co-mingled, give green, but a whitish-coloured sensation. This fact was also subsequently elaborated by Helmholtz, who pushed his inquiries into the spectrum itself, and, by blending

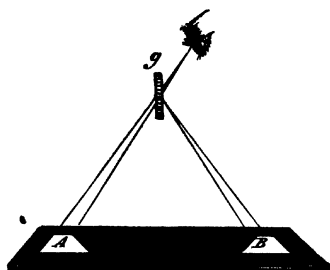


FIG. 4.

the lights, obtained valuable results. Blue-green, when mixed with red, instead of giving a brownish or greenish grey, as with pigments, was found, like ultramarine blue and yellow, to also constitute white light. With pigments, a mixture of chrome yellow and ultramarine blue, in variable quantities, forms different tints of green. Microscopic examination of this compound does not reveal the separate particles of yellow and blue pigments, but simply the greenish hue. The real and obvious distinction between spectrum and pigment combinations is that the former are additions, while the latter are subtractions. Knowing this, it will at once be evident that the colours obtained by these two methods cannot coincide.

The following are some of the results of combining coloured lights and pigments respectively :—

TABLE III.

## COMPOUNDS OF COLOURED LIGHTS.

Red + green = yellow. Should the green be slightly bluish  
= white.

2 red + green = orange.

Green + blue = sea-green.

2 green + blue = greenish sea-green.

TABLE III.—*continued.*

Blue + red = purple.  
 2 blue + red = violet.  
 Red + green + blue = white.  
 2 red + green + blue = white + red, or pale red.  
 2 red + 2 green + blue = white + yellow, or pale yellow.  
 Red + 2 green + 2 blue = white + sea-green, or pale sea-green.  
 2 red + green + 2 blue = white + purple, or pale purple.

TABLE IV.

## •COLOURS RESULTING FROM COMBINING PIGMENTS.

Primaries.	Secondaries.	Tertiaries.
Red + yellow = orange.	2 R + Y + B, or O + P = russet.	
Yellow + blue = green.	2 Y + R + B, or O + G = citron or greenish olive.	
Blue + red = purple.	2 B + R + Y, or G + P = olive.	

9. *Primary Colours.*—Writers on the pigment theory are all agreed as to the selection of the simple colours; but scientists have, in treating of this subject, chosen several sets of hues as primaries. Young and Helmholtz take red, green, and violet; vermilion, emerald-green, and ultramarine blue are selected by Maxwell. When the subject of colour is considered with a view to its practical application to the arts, it is needful to base all combinations on the scheme elucidated by Chevreul, Hey, Field, and others—that red, blue, and yellow (Plate III., Nos. 1, 2, and 3) are primary colours, and all others the resultants of mixing them in variable quantities. For technical purposes, it is therefore only feasible to deal with colour as it changes, according to the pigments combined; hence red, yellow, and blue will be regarded as primaries, because, when mixed with each other and with black and white, every possible shade of colour may be obtained.

10. *Compound Colours.*—These are of two classes—secondaries and tertiaries. The secondaries—green, orange, and purple (Plate III., Nos. 4, 5, and 6)—are composed of two primaries, while the tertiaries—russet, citron, and olive (Plate III., Nos. 7, 8, and 9)—are composed of two secondaries. Orange



and purple produce russet or reddish brown; orange and green produce citron or greenish olive; and green and purple, olive. On reducing these shades to their simple elements, it is found that they are each composed of three primaries, with one predominating and giving tone to the colour. Russet, for instance, contains a double portion of red, for red is a constituent of both the orange and purple which enter into its composition; citron contains a double portion of yellow, and olive a double portion of blue.

The hue or tone of a compound colour is determined by the proportionate quantities of the primaries combined in its production. For example, to procure a bluish green, blue must be the predominating and yellow the subordinate colour; while, on the other hand, to obtain a yellowish green, yellow would be the predominating and blue the subordinate colour. Reddish or yellowish orange is got by increasing the red or yellow constituents of this colour; and bluish or reddish purple, by increasing the blue or red components of this secondary. This affords some idea of how colours are modified and multiplied. Taking the three secondaries and subjecting them to similar treatment, a diversity of shades will be found to result. Russet (Plate III., No. 7) is composed of two parts red, one part yellow, and one part blue. It will be obvious that by varying these proportions another series of hues will result. By increasing the red constituent, the warmth of the colour is intensified; by increasing the yellow, the reddish tone is neutralized; while an increase of the blue would add to its depth and saturation. Similar results are obtained by modifying the constituents of the other primaries. Thus citron—composed of two parts yellow, one part blue, and one part red—may be changed to a yellowish, bluish, or brownish citron, according to the quantity of yellow, blue, or red used. Olive, which consists of two parts blue, one part red, and one part yellow, varies from a deep olive-green, brownish olive, to a yellowish olive-green, as the blue, red, and yellow constituents are increased.

The tertiary shades are the most useful colours employed in textile design. They are generally used for the ground of

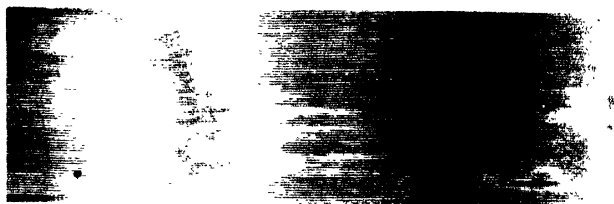
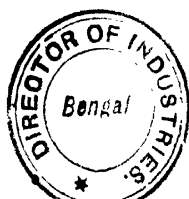


Plate II  
SPECTRAL COLOURING OF FABRICS

1. Woven-design Specimen
2. Printed-yarn ..





the fabric, while the secondaries and primaries are utilized in enhancing the brightness of the pattern.

11. *The Three Constants of Colour.*—The three constants of colour are, *purity*, *luminosity*, and *hue*. If a piece of paper is painted vermillion and placed across the red end of the spectrum, it will be seen to be deficient in purity. Emerald-green and ultramarine blue papers, when compared with their respective sections of the spectrum, are found to be similarly defective. By mixing white light with the colours of the spectrum they may be so adulterated as to correspond with, or match, those obtained by the use of pigments. Artificial colours are never perfectly pure—they always contain some measure of foreign element, which can only be correctly determined by bringing them in contact with the colours of the spectrum. The second constant, *Luminosity* or *Intensity*, depends on the degree of light a colour reflects. Yellow, orange, and red represent the most luminous, and green, blue, and violet the least luminous end of the spectrum. It will be evident that it is possible to have two or more colours of the same degree of purity, but of different degrees of brightness. Two scarlets might both contain the same proportionate quantities of colour and of white light, and yet be dissimilar, simply on account of one being more intense in hue than the other. To match the two colours, the more luminous one would require to be exposed to a dull light, or the less luminous to a bright light. The third constant, *Hue*, is that special property which is caused by a definite refrangibility of light, producing the colour proper. Green and red may be exactly of the same purity and brightness, but they are different in hue, each being produced by a distinct refrangibility of rays.

12. *Temperature of Colours.*—The temperature of the spectrum colours is not uniform. It augments from violet to red. Herschel, by exposing thermometers to the several tints of the solar spectrum, determined the temperature of each colour, and proved that, proceeding from the most refracted or violet end of the spectrum to the least refracted or red end, there is a successive increase of heat. Besides luminous rays, the sun emits a mass of invisible but potent calorific rays. Herschel, pushing

his thermometers beyond the visible red and violet rays, discovered the presence in the spectrum of ultra red rays of intense heat, and ultra violet rays of a less heat. The solar spectrum may therefore be described as consisting of three distinct sections: First, of the ultra and invisible red rays; second, of the luminous rays, red, orange, yellow, green, blue, and violet; and third, of the ultra and invisible violet rays. Though it is thus evident that each spectral colour has a different temperature, yet it cannot be assumed on this basis that a red fabric will possess a greater degree of heat than a blue fabric composed of the same materials; because all rays penetrating a coloured body are not luminous, and yet, whether luminous or non-luminous, they possess properties of heat. Were the rays absorbed by a coloured surface only luminous, then it would be possible, by estimating the measure of absorption, to determine the colour temperature. But the bulk of radiation from any luminous body consists of invisible calorific rays, regarding which colour teaches absolutely nothing. A fact that has to be taken into consideration is, that a body may be highly susceptible to one class of rays, but insusceptible to other classes. As it is generally known that black garments are more effective retainers of solar heat than white garments, it may be pointed out why this is the case. White clothes absorb the invisible rays, but reflect the luminous rays which constitute solar light. Black or dark clothes, on the other hand, not only retain the dark rays which penetrate them, but also the visible rays; and hence they are that degree warmer than white fabrics of the same structure and material, as the difference in the influx of temperature due to the absorption of luminous as well as invisible rays. Tyndall explains that if a white cloth were spread over the snow, it would even act as a shield to the latter instead of assisting it to thaw. Snow, which is ice in a powdered form, absorbs the dark rays with greater avidity than a white fabric; and, as both the particles of snow and the threads of the texture reflect the luminous rays poured upon them, the snow would melt sooner without the cloth than with it. Indeed it would be found that in a short time the cloth would occupy quite a prominence—the snow not covered by it thawing more rapidly than that

over which it is spread. Should a black fabric of similar material be next placed on sunned snow, it would produce the very opposite results. Absorbing the luminous as well as the dark rays, it retains more of the sun's heat than the snow, which rapidly melts under it; while the surrounding and uncovered snow remains comparatively unthawed and icy. Both the white texture and the snow are powerless as regards the luminous rays emitted by the sun; the myriads of fibres composing the former receive no warmth from them, nor can the ice-like atoms of the latter be melted by them. They, in a word, can only be changed by the dark rays. As to the black-surfaced texture, there are different conditions to be taken into account. It is both an absorbent of the invisible and of the luminous rays, consequently dark materials not only attract but retain more of the sun's heat than light materials. More than this cannot be stated with certainty about the warmth-yielding qualities of woven textures of various colours.

## CHAPTER II.

### ATTRIBUTES OF COLOURS.

13. Utility of a Knowledge of the Qualities of Colours—14. Qualifications of the Textile Colourist—15. Functions of Pure Colours in Design—16. Red: its Characteristics—17. Methods of Modifying Colours—18. Derivatives of Red: their Qualities and their Province in Textiles—19. Blue: its Properties and Uses—20. Derivatives of Blue and their Application to Woven Textures—21. Shades and Tints of Blue mixed with Shaded and Tinted Reds and Yellows—22. Methods of obtaining Well-balanced Colourings—23. Uses of Blue in Twist Yarns—24. Points in the Application of Blue and Red to Textiles Summarized—25. Attributes of Yellow—26. Province of Yellow in Woven Fabrics—27. Derivatives of Yellow—28. Secondary Colours—29. Green: its Attributes and Derivatives—30. Tints of Green—31. Orange: its Shades and Tints—32. Purple.

13. *Utility of a Knowledge of the Qualities of Colours.*—<sup>1</sup>In order to apply colours artistically to woven fabrics, one must be conversant with the attributes of the tints, tones, and hues of colour the technologist uses in his work. More is requisite than a mere acquaintance with the technical details which lie at the basis of the construction of useful and decorative fabrics: this knowledge must be supplemented by practice and training in the blending of pure and other shades, and in the origination of novel schemes of colouring. Exact knowledge of the quality and application of colours, and of the laws which determine harmony of colouring, is indispensable to the successful textile designer. The pattern originator must display in his work a reliable conception of the province of colour in woven style; this is as essential as it is to the manufacturer to have regard to the chemical composition, physical structure, and clothing qualities of the materials used. As in blending wools and other fibres, the nature and properties of each are taken into account, so in colouring woven manufactures, the attributes of the several

shades and the method of arrangement require to be carefully considered.

14. *Qualifications of the Textile Colourist.*—One of the primary qualifications of a colourist is natural aptitude for his work. To “feel” or appreciate harmony and contrast of colour, the eye of the observer must convey to the mind an accurate impression of the *ensemble* of shades visible. Two things are requisite—intuitive and acquired taste for colouring, combined with practice in textile designing. Yet these are insufficient. They may enable one to judge of the purity of colours, or of the degree in tone between two or more hues; but this faculty for matching of colours, or of colour discrimination, however acute, does not constitute that sense for harmony of colouring which would make it a transgression of nature for a designer to originate incongruous colour compounds. Another quality is needful. It may be said to be practically, if not wholly, an intuitive talent, for it may be displayed in the work of those who possess but slender knowledge of the laws and theories of colour. There must be taste or genius for colouring. Such is the perfection in which some designers have this natural faculty for colour blending and application, that they are a law in themselves. Natural talent is the source of inspiration. This faculty is invariably the better for culture. As a capacity for music may be developed by training, so a power for colouring may be augmented by studying harmony and contrast, and the general principles of the science as they relate to the development of patterns in the loom; consequently, though culture may not create that acuteness of conception exercised by those who have an intuitive bent for harmonious assortments of hues, yet it may result in producing a passable, if not a proficient colourist, and is, moreover, calculated to direct even the naturally talented to a judicious selection and use of materials.

15. *Functions of Pure Colours in Design.*—Before treating of the attributes of the primary and secondary colours, namely, red, blue, yellow, green, orange, and purple, it may be useful to allude to the application of these colours to the various types of woven decoration. Some designers so rarely use such hues, unless tempered with either white or black, that they seem to



entertain an idea that they can only be made to yield strong and harsh contrasts. Certainly this is likely to occur if they are not combined with due regard to intensity and quantity of hue, the methods of distributing the several colours, and the relative effect they have on each other in the woven fabric. Bright colours should always be applied to textures for the purpose of imparting tone and character of pattern. Though, generally, they do not form the groundwork of the style, yet they should give additional lustre to the design. What such hues are in decorative and pictorial art, they are also in loom productions when skilfully employed.

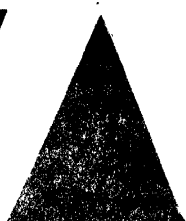
Showy styles in which the primaries or bright colours are present, result more from the system of combination practised than from excessive brightness. The Indian shawl—or the Paisley imitation—and the Turkey or Persian carpet, not infrequently consist of designs composed of the most brilliant shades producible in the dye vat. In the former, in addition to a play on certain figures, which are generally unique in arrangement and ingeniously grouped, there is a depth and fulness of tinting that seems to possess all but a permanent freshness. As to the Eastern carpet, it contains a large diversity of colour, and mostly of a bright tone, but still the general effect is pleasing and cheerful. To what are the congruity of tone and richness of colouring due in these textures? This law is observed in their composition: the quantity of each colour used, depends entirely on the position it occupies in the pattern and on its intensity and quality; while the several shades are so blended that when the carpet or shawl is viewed in its entirety the whole is harmonious in result. This is the general effect sought after in tweeds and all classes of fancy fabrics. If scarlet, blue, green, crimson, or orange were applied to a woven design, —though decidedly stronger in hue than the shades forming the bulk of the fabric—while tingeing the pattern with a freshness of tone, they should not be allowed to unduly attract the eye. The use of twist yarns very largely facilitates the production of congruous combinations, in which bright colours play a prominent part in the composition of the pattern. By employing these threads, the colours may be broken up, in which form they



1



2



3



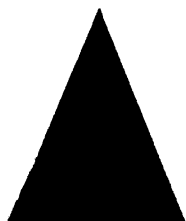
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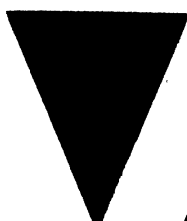
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6



7



8



9

Plate III  
PRIMARY, SECONDARY AND TERTIARY COLOURS

in these compositions is the brightening or toning hue.\* In applying red tints to worsted and woollen fabrics, they should seldom occur in patches or in continuous lines of a check arrangement, but they should be more or less intermittent in effect.<sup>1</sup> It should be borne in mind that in these fabrics it is not loudness or showiness, but neatness of style, that is sought after, yet the quality of brightness must not be lacking. In the form of twist yarns, reds and scarlets may be made to produce exactly the general toning required. This mode of applying this colour is particularly well adapted to textures of a cheviot and tweed description. Worsteds require different treatment. One method of introducing reds into these fabrics consists in using silk yarns, and simply bringing them on to the surface to form a bright spot or minute line of colour. In silk, cotton, and some kinds of linen textures, this primary is used in larger quantities, and more liberally displayed in patterns composed of these materials, than in the ordinary run of woollen and worsted fabrics.

Being such a potent and bright colour, it is of utility in the blending process of manufacturing, when several shades of materials are combined to produce a mixture yarn. Some mixtures or blends of this class contain scarlet wools, which, in whatever form they occur, give tone and quality to the combination of which they form a part. A variety of tints and shades results from mixing red in different quantities with black or white, and also an extensive range of hues from combining it with other colours. Still, pure red is not so liberally used in textile work as its derivatives: thus, it unites with yellow and blue in the production of orange and purple. Should a small quantity of yellow be added to red, it gives scarlet, while the addition of a small quantity of blue produces crimson. The richness and luminosity of the scarlet are determined by the proportion of yellow added; and the depth of the crimson by the amount of blue entering the mixtures. Both in scarlets and crimsons, a considerable diversity of hues is obtainable. Before either of these colours is pro-

<sup>1</sup> Tartans are special forms of checks in the colouring of which this principle is not observed.

duced, red undergoes a series of gradations of hue. In the rose, there is displayed to perfection the various modifications in tint and shade of which this colour is susceptible. Scarlets, crimsons, maroons, russets, and browns are all hues employed by the weaver that obtain their prevailing tint from this primary.

17. *Methods of Modifying Colours.*—All pure colours, such as red, blue, yellow, orange, green, and purple, may be subjected to three kinds of modification: first, they may be darkened in *tone*; second, lightened in *tint*; and third, changed in hue. If, for example, black is mixed with red in various proportions, it produces *tones* or *shades* of this colour, while an admixture of white with red yields different *tints* of red. To alter the hue, it is necessary to blend it with some other colour, such as blue, when various shades of full-toned crimsons result. In blending, and also in the arrangement of colours in the warp and weft of the woven fabric, the phenomena underlying the changes producible in the tone and tint of a colour have to be taken into consideration. Black and red wools when scribbled together give a dark brown or reddish-brown mixture, according to the quantities of the respective shades entering into the combination; on the other hand, if white and red wools are blended, a mixture of a pinkish character is obtained. Hence it is clear that the same principles which determine the alteration in the shade, tint, or hue of a colour when pigments are combined, also regulate the results due to mixing several colours of textile fibres.

Strictly speaking, white and black cannot be designated colours, being merely representative of the principles of light and darkness, and acting, in the multiplication of shades and tints, as the great modifiers of colour. Such is their province in the rôle of colour production. In design, they are indispensable in mellowing certain combinations of hues, and in giving precision and clearness to specific sections of a pattern. As ground shades they are also useful. Light colours appear bright and distinct on black surfaces; while deep colours, such as blues, purples, and reds, appear intense and clear on white materials. So that by a proper use of these shades it is possible, in the first place, by the process of mixing them with bright colours, to produce a variety of hues; and, in the

- second place, by introducing them into the warp and weft of the pattern, to impart smartness and lustre to the colours employed.

18. *Derivatives of Red: their Qualities and their Province in Textiles.*—By the derivatives of a colour, are signified those shades and tints which result from mixing it with various quantities of white or black. Those obtained from red are both numerous and important, being specially useful in the production of woven effects. They comprise both ground and fancy hues. First, in the category of the derivatives of this primary, are those shades produced by toning it with black. A few typical specimens of these are given in Nos. 1, 2, and 3, Plate IV. The brightest shade (No. 3) is compounded of three parts of red and of one part of black; the medium shade (No. 2) of equal quantities of red and black; while in the dark brown (No. 1) black preponderates, the proportions being one part of red to three parts of black. Such shades of brown may be used as ground colours, but the two latter are the most appropriate for this purpose. Shade 3 is, however, frequently employed with good results in dress fabrics for the foundation of the texture. Some excellent colourings ensue from their combination. The two extremes.—Shades 1 and 3—when employed in the same style give a softly toned pattern. A less pronounced contrast ensues from a compound of Shades 1 and 2, or Shades 2 and 3. In combinations of this kind, there should usually be a larger quantity of one colour element than another. Another method of combining these shades consists in introducing the three into one pattern. For example, if twelve threads of Shade 1, eight threads of Shade 2, and four threads of Shade 3, were woven together and checked over in the weft by a similar arrangement of yarns, a neat design would be obtained. It might be changed by taking four threads of Shade 1 instead of twelve, and twelve threads of Shade 3 instead of four. In the former style the dark brown would preponderate, but in the latter the light brown, the quantity of the medium hue being the same in each instance. These illustrations demonstrate the utility of these shades and the systems on which they are amalgamated in pattern construction.

The tints Nos. 4, 5, and 6, on Plate IV., are characterized by brilliance and intensity of tone, making them adapted for imparting lustre and richness to design. Like the colour from which they obtain their specific tint, they are ostentatious and potent in effect. While the shades given in Nos. 1, 2, and 3 are all darker in tone than the original red, these tints are lighter on account of the entrance of white into their composition. Thus they are made up as follows:—

Tint 4, Plate IV.—1 part of red and 3 parts of white.

Tint 5, „ „ —2 parts of red and 2 parts of white.

Tint 6, „ „ —3 parts of red and 1 part of white.

Bright tints of this kind are extensively used in figured weaving, as in the manufacture of vestings, silk neckties, dress fabrics, and trimmings. Sometimes in the latter description of textures they form the pattern proper. In the ordinary run of woollen and worsted cloths they are, however, only sparingly employed, and that in the form of twist yarns. Amongst the varieties of twists which can be produced by combining two or more of these shades and tints of red, the following are selected as suggestive illustrations:—

I.—One thread of Shade 1 twisted with one thread of Tint 4, Plate IV.

II.—One thread of Shade 1 twisted with one thread of Tint 6, Plate IV.

III.—One thread of Shade 2 twisted with one thread of Tint 5, Plate IV.

IV.—One thread of Shade 3 twisted with one thread of Tint 4, Plate IV.

V.—One thread of Shade 1; one thread of Shade 3; and one thread of Tint 4, Plate IV., twisted together.

Each of these compound yarns, in worsted, woollen, or cotton materials, is capable, when judiciously applied, of contributing to the quality of woven pattern.

Another section of manufacturing in which these derivatives are employed is in the blending process, or in the production of fancy mixture yarns.

19. *Blue: its Properties and Uses.*—Blue (No. 2, Plate III.) is

one of the most valuable colours used by textile designers.° In dark shades it is utilized for the ground of patterns; in medium shades it is employed for mellowing and toning purposes; while bright blues convey freshness and force of colouring; so that this primary has three distinct functions in textile designing. In each of these, it will be indicated what its properties are as a colour, and the relation it sustains to other shades with which it may be combined.

Unlike red, which is decidedly a warm colour, the quality of blue is cold and retiring: this distinguishes it from yellow, orange, and red, which produce a sensation of warmth. Resembling violet and purple, it is indistinct and neutral in a declining light, but strong and brilliant in a bright light; hence, when applied to light grounds, it is not only pronounced in hue, but is quite distinct from other shades, while on a dark or black surface it is both mellow and lustrous in effect.

Its property of "coldness" renders it a useful shade for subduing the redness of tone of some colourings; for it in some degree neutralizes the warm hue of the browns, maroons, russets, or other shades forming the pattern in which red is prevalent. This does not, however, indicate that red and blue harmonize; on the contrary, whenever these two colours are associated in large quantities, the resultant composition is somewhat incongruous; but that when combined with browns and russet olives, or shades in which the red tint is assimilated by the quantity of black they contain, blue can be made to yield excellent coloured effects. Pure blue, like pure red, is not so largely used as its derivatives, still it has a place in textile designing. This is principally as a fancy yarn, when it gives freshness and bloom to the pattern. It is also employed as a ground colour in the manufacture of fine silk fabrics, and as the figuring colour in certain makes of fancy worsteds.

20. *Derivatives of Blue and their Application to Woven Textures.*—If blue is mixed with black, shades of ~~an~~ indigo character result; but, if mixed with white, peacock blues, lavenders, and pale blues are formed. Some few examples in both these types of derivatives may be considered. From the series of dark or shaded blues three examples have been selected,

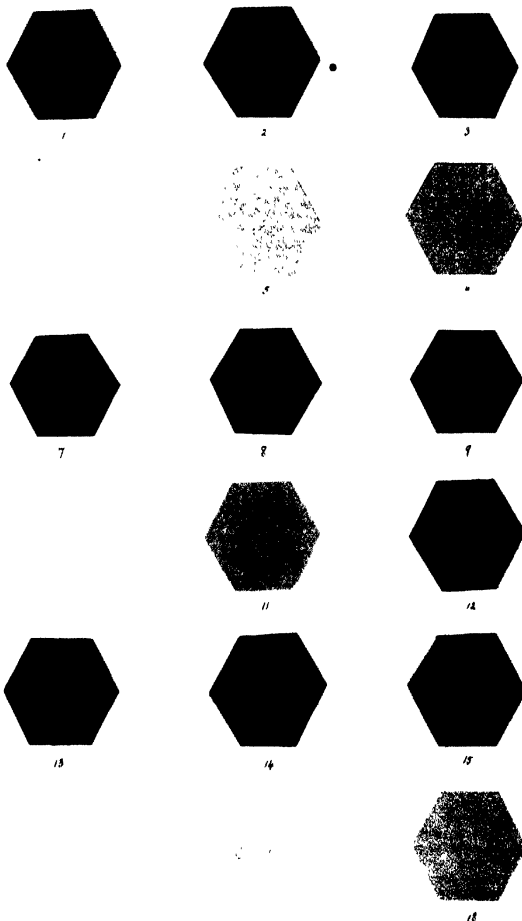


Plate IV  
TONES AND TINTS OF THE "PRIMARIES"

1. 2. 3. Tones of Red	4. 5. 6. Tints of Red
7. 8. 9. " " Blue	10. 11. 12. " " Blue
13. 14. 15. " " Yellow	16. 17. 18. " " Yellow







namely, those in Nos. 7, 8, and 9, Plate IV. The first consists of one part blue and three parts black; the second (No. 8) of two parts blue and two parts black; and the third (No. 9) of three parts blue and one part black. Shade 1 (indigo) is a useful colour for piece-dye goods, as well as for the grounds of fancy fabrics. By studying this method of mixing, it will be observed how a pure and intense colour may be gradually darkened in shade, or—if white is added—gradually lightened in tint, until it closely resembles black or white, as the case may be. This system of varying the tone of a colour makes it feasible, by a proper assortment of hues, to produce stripes or checks in light or dark shades. Take, for example, the three blues given in Nos. 7, 8, and 9 on this Plate. If these are put together thus: eight threads of Shade 7, eight threads of Shade 8, and eight threads of Shade 9, a shaded blue check will result, which in worsted, woollen, or cotton yarns gives a satisfactory pattern. Let the warp thus arranged be crossed with similar quantities of the respective shades, and checks of the several blues will be formed in the fabric. This plan of colouring produces checks of equal proportions of the different shades; but, if needful, these might be easily got in various dimensions, say, for instance, the darkest check about three-quarters of an inch in size, and the remaining two checks half an inch.

A few of the principal tints of blue, got by mixing this primary with white, in the same proportions as the shades just described were produced by mixing it with black, are Nos. 10, 11, and 12, Plate IV. The white has given them a softened and mellowed tone, having neutralized that forcible and striking attribute which characterizes pure blue. On comparing them with the original colour from which they result (No. 2, Plate III.), the degree to which white subdues and mellows bright hues with which it is blended will be evident. Tints of this class are used in various ways in designing. Some styles in silk handkerchiefs are producible by the exact depth of hues seen in the illustration—these weights of colours forming congruous and evenly-balanced patterns. They are also largely employed in cotton textures. One example of this type of combination is given in No. 1, on Plate VII. This is a sketch

of a fabric made of cotton yarns. The warp is light blue—Tint 10, Plate IV.—and the weft a deeper blue, or Tint 12. The neatness of this colouring is due to the soft contrast between the tints of the warp and weft yarns.

21. *Shades and Tints of Blue mixed with Shaded and Tinted Red and Yellow.*—In the styles in which blue is employed for ground purposes, indigo shades are invariably used. Blue, however, is not a foundation colour that admits of much diversity of tinting. To succeed in its application to the grounds of patterns, a good range of browns, olives, and greys is important. With shades of the olive class it gives the most marked contrasts. This is due to yellow being the prevailing tint of this compound hue. But it also mingles harmoniously with certain tints of grey and brown. Patterns in which these shades are arranged as in Tables V. and VI., in woollen, worsted, cotton, or silk yarns, illustrate the methods of combining blue effectively with different shades and tints of red and yellow. In Table I. the combinations of shades are included; but in Table II. will be found the tints of red, blue, and yellow. The colours are given in groups of six threads, and would, providing the arrangements appended were carried out in the weft, produce a series of clearly developed check effects.

TABLE V.

COMPOUNDS OF SHADES OR TONES OF COLOUR.

(a) *Shades of Blue and Red (Plate IV.).*

**Ex. 1. Dark shades.**

**Black preponderating.**

6 threads of dark blue (Shade 7).

6        "        "        brown (Shade 1).

**Ex. 2. Medium shades.**

**Black and Blue, and Black and Red equally mixed.**

6 threads of medium blue (Shade 8).

6 brown (Shade 2).

TABLE V.—*continued.*

Ex. 3. Lightish shades.

Blue and Red preponderating.

6 threads of toned blue (Shade 9).

6 „ light brown (Shade 3).

(b) *Shades of Blue and Yellow (Plate IV.).*

Ex. 1. Dark shades.

Black preponderating.

6 threads of dark blue (Shade 7).

6 „ „ olive (Shade 13).

Ex. 2. Medium shades.

Black and Blue, and Black and Yellow equally mixed.

6 threads of medium blue (Shade 8).

6 „ „ olive (Shade 14).

Ex. 3. Lightish shades.

Blue and Yellow preponderating.

6 threads of toned blue (Shade 9).

6 „ „ olive (Shade 15).

TABLE VI.

COMPOUNDS OF TINTS OF COLOUR.

(a) *Tints of Blue and Red (Plate IV.).*

Ex. 1. Very light tints.

White preponderating.

6 threads of pale lavender (Tint 10).

6 „ „ salmon (Tint 4).

Ex. 2. Light tints.

Blue and White, and Red and White equally mixed.

6 threads of lavender (Tint 11).

6 „ bright salmon (Tint 5).

Ex. 3. Deep tints.

Blue and Red preponderating.

6 threads of tinted blue (Tint 12).

6 „ red (Tint 6).

TABLE VI.—*continued.*(b) *Tints of Blue and Yellow (Plate IV.).*

Ex. 1. Very light tints.

White preponderating.

6 threads of very pale yellow (Tint 16).

6     "     pale lavender (Tint 10).

Ex. 2. Light tints.

Blue and White, and Yellow and White equally mixed.

6 threads of lavender (Tint 11).

6     "     pale yellow (Tint 17).

Ex. 3. Deep tints.

Blue and Yellow predominating.

6 threads of tinted blue (Tint 12).

6     "     "     yellow (Tint 18).

22. *Methods of Obtaining Well-balanced Colourings.*—From these Tables it will be evident that if the shade of blue is modified, that of the combining colour is also changed. Unless this rule is adhered to, the arrangement adopted will give incongruous results. Only a certain depth of blue harmonizes with a corresponding depth of brown and olive; if one predominates over the other, the colouring becomes deficient and displeasing to the eye. For example, if Shades 1 and 9 and Tints 4 and 12 were blended, the result would not be so mellow as if Shades 1 and 7 and Tints 4 and 10, as in the Tables, were combined. The reason for this is that, in the first instance, a shade of red in which black preponderates is used with a shade of blue in which blue preponderates; while, in the second instance, a tint of red in which white preponderates is associated with a tint of blue in which blue preponderates; whereas, to produce a perfect balance of colour—that is, providing the quantities of the respective colours are equal—it is necessary for the shades or tints combined to contain exactly the same quantities of black and white, as in the combinations of Shades 1 and 7, and Tints 4 and 10 of Plate IV.

In no combination given in Tables V. and VI. is there a lack of harmony; indeed, considering the principle on which they

have been obtained, this is almost impossible. Thus, take Ex. 1 in Table V. Here, dark shades of blue and brown are associated. In both colours black preponderates; that is to say, the former is composed of three parts of black and two parts of blue, and the latter of three parts of black and two parts of red. Providing the primaries blue and red (Nos. 1 and 2, Plate III.) harmonize, these shades, which are their derivatives, will also mix well together. A test to which they can be submitted is to view them side by side. If slips of these shades are thus combined, they do not appear incongruous and harsh in tone, but possess a soft and mellow aspect, and in this consists the true characteristics of harmonious colourings. As the tints are worked out on the same system as the shades, they form useful compounds. In order that this important element of congruous colour effects may be clearly understood, let Ex. 1 of Table VI. be also briefly examined. Such a combination can only yield an agreeable pattern. Whether these tints are blended in the wool or in the yarn, the resulting mixture is satisfactory. This arises from the weight or depth of colour of the respective tints being identical; in other terms, the intensity of the tinted red is precisely the same as that of the tinted blue. In dress stuffs, tennis flannels, fabrics for trimmings, silks, and extreme fancy textures, this blend of tints is invariably pleasing. Equally harmonious results may be arrived at by combining tinted red (No. 4) with tinted yellow (No. 16), or tinted blue (No. 10, Plate IV.) with tinted yellow. In each of these compounds, delicacy of tint and mellowness of hue are the prevailing qualities.

23. *Uses of Blue in Twist Yarns.*—Having now treated of blue as a ground colour, and also as a shade for blending with other hues to tone down a style or subdue its coloured aspect, it only remains to indicate its utility as a colour for twist yarns. It is a valuable shade for this purpose. As it is a bright but not a showy colour, it is particularly suitable for fancy two- or three-ply yarns. Twists in which red, yellow, or orange are used, have a tendency to overpower the general colouring of the pattern in which they appear, but this is not the case in fancy yarns in which blue is the principal colour. Such twists, while impart-

ing lustre and freshness to the design, in no wise detract from its beauty of colouring, though that may be of a comparatively subdued character. The following are a few examples in two-ply yarns in which blue threads are employed: black and blue; white and blue; brown (No. 1) and tinted blue (No. 10); dark blue (No. 7) and tinted red (No. 4); blue and yellow; dark blue and shaded red (No. 3, Plate IV.); and medium blue and white.

24. *Points in the Application of Blue and Red to Textiles Summarized.*—The analyses which have been made of the use of blue and red in woven designs, have demonstrated that, whenever primary colours are applied to textile fabrics in their purity and natural intensity, it is in comparatively small quantities. Brilliance of hue causes the application of primaries in large patches to textile surfaces to be undesirable. In dress fabrics, bright blue, red, and yellow have an important place. Mantlings, shawls, wraps, and travelling rugs also provide scope for a liberal use of these shades; but in treating designs with colour for fabrics of the coating and trousering class, subdued and indefinite shades prove the most useful. Red and blue are valuable to impart tone and newness of character to the style. The groundwork of the pattern should first have attention—the intensity and strength of the bright colours depending on the mode of application. Should the ground colouring of a pattern be strong and harsh, the addition of green or blue will, in some cases, give it a mellow quality; or should it lack brightness, then red, orange, or yellow, if applied in small quantities and properly distributed, will relieve the heaviness of the colouring and impart the requisite freshness of aspect. Success in the use of pure colours is determined by the quantities in which they occur, and by the nature of the shades with which they are associated. Bright red, however sparingly employed, if applied to a mixture of brown or russet shades, cannot but form an incongruous colouring; but if applied to an assortment of shades in which soft-tinted blues and greens are conspicuous, both harmony and contrast of composition would result.

25. *Attributes of Yellow.*—This colour (No. 3, Plate III.) is generally understood to be emblematical of purity and brightness.

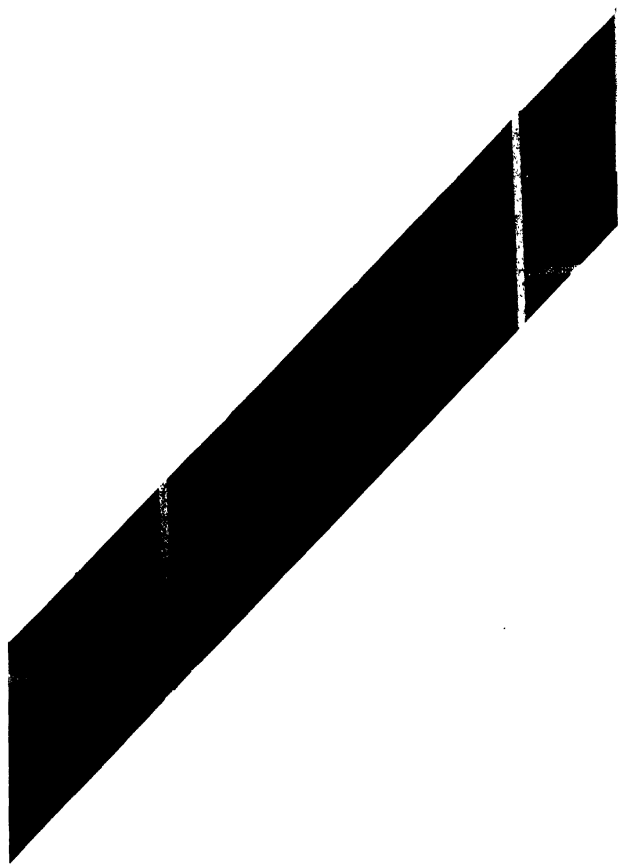


Plate V

PLAID IN WHICH YELLOW IS THE BRIGHT OVER CHECKING COLOUR





It is the most luminous tint in the spectrum. Purple is its complementary and contrasting hue. Intense yellow—rich, bright, and cheerful—has the same relation to light or whiteness as blue has to darkness. It lacks the lustrous quality of red and the retiring, mellow characteristic of blue, but possesses vividness and lustre. Luminosity and brilliance of hue limit its application to textile design; yet it has a sphere which no other colour can occupy. Thus, in patterns in which white yarns and light or delicate shades are employed, it is one of the most important fancy colours it is possible to introduce into the fabric. Mingled with such shades, it loses a degree of that prominence and individuality of tint which characterizes it when applied to patterns possessing dark and sombre grounds.

Another quality of this primary is vividness—no colour being comparable with it in this sense. Orange possesses this attribute, but not so largely as positive yellow. Its characteristic freshness, but comparative lightness of hue, imparts to it a clear and decided tone on black or dark surfaces. Hence it is found that when yellow is blended with light and medium greys and lavenders, its property of lustre suffers in intensity; whereas, if it is applied to dark blue, dark brown, or black materials, its vivid attributes are forcibly distinguished. When these modifications, which this and other bright colours undergo according to the qualities of the several shades with which they may be combined, are clearly understood, the possible effect of their application to any pre-arranged scheme of ground colours may be estimated. Obviously there are three factors to be carefully considered when employing primary hues: first, the nature of the contrast resultant when the colours are placed on light materials; second, on medium-toned grounds; and third, on textures composed of dark yarns. Yellow is somewhat lessened in distinctiveness on the first, but improves in intensity on the dark grounds, being only slightly changed when arranged side by side with shades of a medium depth.

26. *Province of Yellow in Woven Fabrics.*—Pure yellow is but sparingly used in textile designing. In tweeds and worsteds it is combined, to a limited extent, with other shades in the con-

struction of fancy twist and mixture yarns. It is the principal colour in the following two- and three-ply yarns: black and yellow; blue and yellow; indigo blue and yellow; dark grey and yellow; black, purple, and yellow; black, medium grey, and yellow; and black, red, and yellow. When used in this form it may add lustre and freshness to an otherwise sombre style. It possibly gives the best results in tweeds, where the fibrous nature of the texture helps to minimize its excessive brightness. Yellow is also applied as a self-coloured yarn to certain styles of check patterns for woollen travelling mauds, shawls, and rugs. An example of a plaid pattern of this description is given in Plate V. There are contrasts of dark green and red, dark green and blue, black and red, and also yellow as an intermediate colour between green and red, and as a checking colour on the black. Yellow is thus used for two purposes: first, as a divisible hue, contrasting with the green, and harmonizing with the red; and second, as the strongest contrast possible on the black. It gives what may be termed the chief checking lines to the plaid, and produces freshness and lustre in the style. These lines are of sufficient width considering the brightness and vividness of the colour, which are two qualities to be taken into account when using colours in combination with other bright shades.

27. *Derivatives of Yellow.*—These are both numerous and important. When blended with blue, as previously explained, hues of green are formed, comprising myrtle green, sea green, emerald green, and grass green, all of which vary in tint according to the intensity of the bluish and yellowish elements entering into their composition. Yellow with red, on the other hand, yields an assortment of scarlet and orange hues. Yellow with white gives delicate tints of a straw, lemon, and primrose class (see Nos. 16, 17, and 18, Plate IV.); while with black it forms many shades of an olive character, such as those supplied in Nos. 12, 14, and 15 on the same Plate. If it should be mixed with grey, it produces various tints of drab; so that this primary is a very useful colour for blending with other hues in the production of compound shades.

28. *Secondary Colours.*—The attributes and functions of the

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tints of red, harmonious and contrasting combinations ensue. Amongst the shades used in textiles derived from this secondary, are myrtle greens, olive greens, slate greens, and dark greens. Colours of this description are useful in textile work.

The spectrum green is only applied to extreme fancies, and then chiefly as an extra, spotting, or figuring yarn; in tweeds and worsteds, however, it forms an appropriately coloured yarn for twisting with other threads of such shades as will neutralize a degree of its intensity and lustre. In fact, green is one of the most useful colours for twisting purposes employed in textile designing: such twists as black and green, scarlet and green, and white and green illustrating its utility in the production of fancy yarns for tweeds.

Derivatives of green, due to its admixture with black, comprise a fair diversity of medium and dark shades which are employed as ground colours, and also for piece-dye textures. Three examples in such shades are Nos. 1, 2, and 3, Plate VI. In the first, black is the preponderating element, but in the third, green is the prevailing hue. With the red browns given in Nos. 1, 2, and 3 on Plate IV., they form perfect contrasts. The most pleasing combinations are those in which the greenish derivatives are blended in equal quantities with the reddish browns as follows: dark green (No. 1, Plate VI.) with dark brown (No. 1, Plate IV.); medium green (No. 2, Plate VI.) with medium brown (No. 2, Plate IV.); and toned green (No. 3, Plate VI.) with light brown (No. 3, Plate IV.). An endless variety of striped and checked patterns in woollen, worsted, and cotton materials is got by combining these shades on the lines just indicated. Some excellent ground twists result from combining dark brown (No. 1, Plate IV.) and toned green (No. 3, Plate VI.); dark green (No. 1, Plate VI.) and light brown (No. 3, Plate IV.); and medium green (No. 2, Plate VI.) and medium brown (No. 2, Plate IV.).

30. *Tints of Green.*—The admixture of green with white results in the formation of tints of pea-green. (See Nos. 4, 5, and 6, Plate VI.) These blend harmoniously with the tinted reds given on Plate IV. For example, the pea-green, No. 4, Plate VI. when blended with the whitish pink, No. 4 of Plate IV.,

the pale green, No. 5, Plate VI., with the rose colour, No. 5, Plate IV., and the tinted green, No. 6, Plate VI., with the tinted red, No. 6, Plate IV., all form satisfactory contrasts. As the tints of the respective couplets perfectly balance, being of the exact depth of hue, they constitute mellow and choice combinations. Though these tints are not extensively employed in fancy woollen and worsted fabrics, still there are some classes of these textures in which they are used for ground purposes. One illustration of this kind is pattern No. 2 on Plate VII. The twilled ground of the fabric is a similar tint to No. 4, Plate VI., while the spotting yarns are two-ply, namely, tan and white, and crimson and white twists. The white feature of the colouring serves a twofold purpose: first, it neutralizes and subdues the intensity of the crimson and tan threads; and, second, it imparts precision to the mottled figuring.

31. *Orange: its Shades and Tints.*—Next to red, orange (No. 5, Plate III.) is the most intense, showy, and potent colour. It is closely allied to both red and yellow, of which hues it is composed. Orange is more luminous, but less intense than pure red, and is warmer, but not so bright in hue as yellow. Its potency of hue causes it to suffer little impoverishment either in lustre or intensity from juxtaposition with certain shades. With colours of a reddish or yellowish hue, it undergoes the most marked degree of modification; with blues and greens, and also with their derivatives, its quality is not perceptibly diminished. Whether distributed on dark or light surfaces, it stands out with lustre and freshness, and hence is one of the most appropriate colours for imparting brightness, or for giving to any combination of shades, lacking these qualities, a rich appearance.

Shades of orange (Nos. 7, 8, and 9, Plate VI.) are designated brownish olives, possessing warmer attributes than the shades derived from yellow, but wanting that strength and richness of hue characterizing the russet browns resulting from mixing red with black. As ground colours they are of utility to the textile colourist. With shades of green they form complementary combinations, as the following examples illustrate:—

- I. Dark brownish olive (No. 7) with dark green (No. 1, Plate VI.).
- II. Medium brownish olive (No. 8) with toned green (No. 2, Plate VI.).
- III. Light brownish olive (No. 9) with medium green (No. 3, Plate VI.).

These shades also combine satisfactorily with the dark and deep blues given in Nos. 7, 8, and 9 of Plate IV.

From the orange tints (Nos. 10, 11, and 12, Plate VI.) it will be noticed that by mixing white with this secondary, salmon and gold colours are obtained. They are useful in making twist threads, and are also employed, to a considerable extent, in silk yarns in the manufacture of vestings, spotted textures, neckties, and fancies. Satisfactory styles result from combining them with either tints of green or blue.

32. *Purple*.—There is no colour comparable with purple (No. 6, Plate III.) as regards depth of hue. Its characterizing qualities are softness, bloom, and richness of tone. It is a composition of the warm and the cold, and the showy and the quiet elements of the spectrum, namely, of red and blue.

It only yields congruous combinations with a limited range of shades, and these generally belong to the derivatives of yellow. Purple and pure yellow form a very pronounced contrast—an example of which obtains in the common pansy. In this flower, the deep but lustrous tone of the purple opposes the luminous and pure hue of the yellow. From this natural combination of these tints, it is possible to learn with what class of colours purple will form the most effective contrasts. These are shades in which yellow preponderates, such as tans, light olives, and olive browns. To give bloom and richness of aspect to combinations of fawns, olives, and similar shades, purple, in conjunction with white, may be employed. Some excellent tapestries, bordered rugs, and travelling mauds are produced in which this hue is one of the principal colours.

The derivatives of purple are applied to dress fabrics, but are rarely used in textures for men's wear, except for line striping and checking purposes. The examples given in the tints and shades of this colour, in Nos. 13 to 18, Plate VI.,

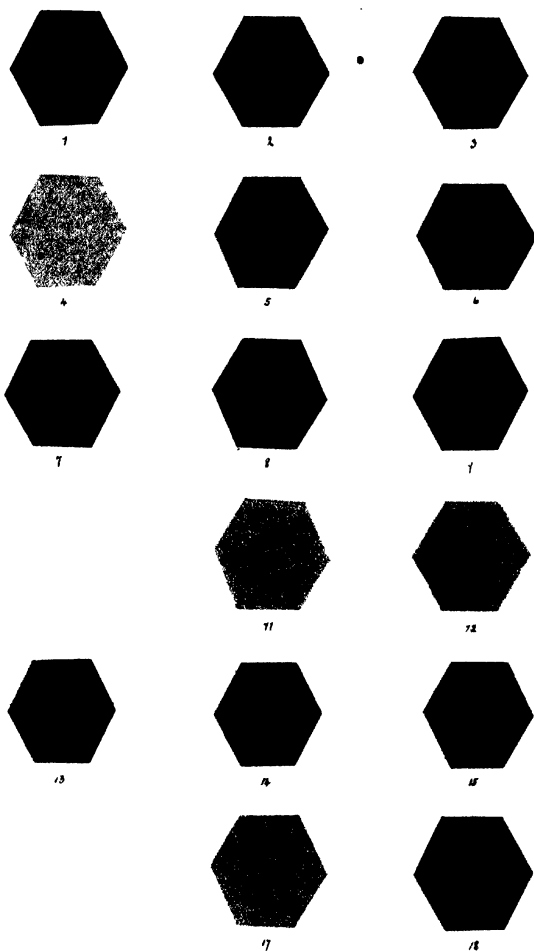


Plate VI

TONES AND TINTS OF THE "SECONDARIES"

1. 2. 3. Tones of Green	4. 5. 6. Tints of Green
7. 8. 9. .. .. Orange	10. 11. 12. .. .. Orange
13. 14. 15. .. .. Purple	16. 17. 18. .. .. Purple





• inclusive, show that its admixture with white produces hues of a lilac class, and with black, hues of a deep indigo blue character. Materials dyed alizarin blue possess a similar purplish bloom as these shades, being warmer and redder in tone than the pure indigos they are dyed to imitate.

Though purple and its derivatives are not largely employed along with other colours in the construction of fancy patterns, yet they are of utility in the blending department of a woollen factory.

## CHAPTER III.

### CONTRAST AND HARMONY.

33. Colours Affected by Adjacent Colours—34. How Colours are Changed by Juxtaposition—35. Contrast—36. Examples in Contrasts—37. Economic Contrasts—38. Two Kinds of Contrasts—39. Poly-chromatic Contrasts—40. Mono-chromatic Contrasts—41. Toned and Tinted Contrasts—42. Comparison of Contrasts by Shade and Contrasts by Colour—43. Shaded and tinted Compositions—44. Bright Colour Contrasts Modified with Black and White—45. Successive and Simultaneous Colour Effects—46. Methods of Neutralizing the Effects of Strong Colour Contrasts—47. Harmony—48. Principles of Harmony.

33. *Colours Affected by Adjacent Colours.*—The intensity, potency, and hue of a colour may apparently undergo change by placing it in juxtaposition with other colours. The process of colour modification has been considered, when it was indicated in what manner hues are subjective to change in proportion to the quantity of black, white, or a colour which forms part of their composition; but the behaviour of colours when in contact or close together remains to be explained. Change of hue and tone of colour originated by the laws of contiguity is both varied and subtle. Trained and practical colourists realize some difficulty in determining the precise nature of the alteration, but it is none the less evident. That the attributes of colours are somewhat modified when the hues with which they are blended are combined, is an essential principle of shade compounds. If, for example, a series of small scarlet spots were woven on black, grey, and white grounds in succession, the hue of the scarlet, when the several fabrics were compared, would prove to be different in appearance in each sample, though the same scarlet yarn were employed in the production of the respective textures.

Cutting away the grounds and comparing the spots from each on a common surface would show that identically the same scarlet had been used in the three fabrics: yet so apparent is their dissimilarity of hue that a casual examination would pronounce them distinct shades. Thus, on the black surface the spots gain intensity and lustre; on the grey they appear murky and dingy; whereas on the white surface the spots are bright, but evidently pale and washy as compared with those on the black ground. On varying the colour of the spots a different set of modifications ensues. Taking blue as the spotting colour, the black ground neutralizes a degree of its bloom and brightness; on the grey it suffers in lustre, but retains its precision of colour, and increases in richness and fulness of tone on the white fabric. Continuing this idea: if a batch of red threads were interspersed in a white warp, a degree of the colour quality would be subdued by the white threads; but should similar yarns be introduced into a black warp, an augmentation in the intensity of the red would be observed, because of the contrast thus created between the sombreness of the black and the rich brightness of the red: a contrast which, if the quantity of the red be large, is sufficient to give a copper-coloured cast to the black threads with which the red is in immediate contact. A law of colours is, that if the fancy shade is lighter than the ground colour, it will increase in brightness of tone; but if, on the other hand, the "fancy" is darker than the coloured surface on which it is distributed, it will suffer in tone. Moreover, if two colours, such as light and dark olive, were arranged together in the same warp, the former would appear lighter and the latter darker than they really are. This illusory alteration is entirely attributable to contrast. Colours of contrasting qualities and tones undergo two modifications when juxtaposed; first, they alter in depth, and, second, in nature of hue. When yellow and blue yarns are woven together, each is subject to this two-fold change produced by contrast; first, as to tone, the yellow becomes brighter and the blue deeper; second, as to hue, each is tinged with the complementary colour of the other.

34. *How Colours are Changed by Juxtaposition.*—It is a

generally accepted principle of colours that when two surfaces of different shades are placed in contiguity, each is changed as though it had been mingled with the complementary of the other. Chevreul relates an incident, in his Treatise on Colours, which so clearly sets forth this important rule that it may be stated here. Certain merchants requested a firm of manufacturers to ornament red, violet blue, and blue woven stuffs with black spots or figures. When the goods were produced, the merchants complained that the spots were not black, as ordered, but that those on the red fabrics were tinged with green, on the violet with dark greenish yellow, while those developed on the blue were toned with a chocolate or coffee-coloured shade. Chevreul,<sup>1</sup> in order to prove that the spots were perfectly black, covered the separate grounds with white paper, when it was at once discovered that the changes in the colours of the spots were entirely due to the contrast ensuing between the black shades and the respective grounds on which the spots had been arranged. All this conclusively shows that colour is a modifier of colour, and hence those hues which possess bloom and richness of tone on one species of coloured surface may be quite different on another. It is a good plan to combine the shades in the precise order in which they are intended to occur on a black ground. Classification in this way enables the colourist to estimate at a glance, without putting the pattern into the loom, the general tone of the shades.

A common law of Colouring is, that the general effect of combining colours is that they appear further apart in the chromatic scale. Thus, when orange and red are combined, the former does not become reddish or the latter orangish, but the red seems to approach purple and the orange to assume a greenish cast. Complementary colours—*i.e.* those farthest apart in hue—are the least affected by association, as is evidenced by the results of such contrasts as red and green, blue and orange, and yellow and purple. An illustration may elucidate this primary principle of colour combinations. If a striped fabric were composed of bands of rose (Tint 4, Plate IV.) and lavender (Tint 10, Plate IV.) colours, one hue would help to give

<sup>1</sup> Chevreul: *The Laws of Contrast of Colour*, p. 120.

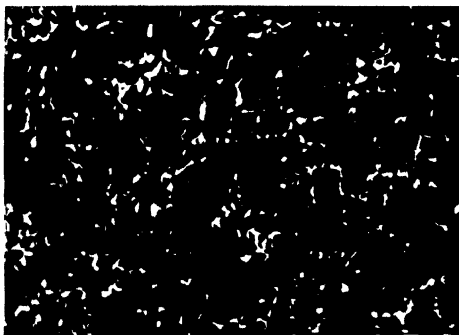
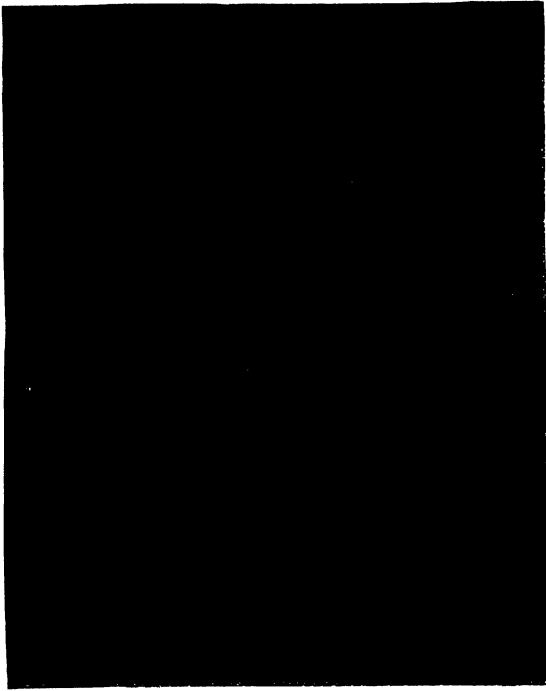


Plate VII

1. BLUE TEXTURE
2. FANCY-TWIST YARN SPECIMEN



prominence to the other, because they strongly contrast with each other. On the other hand, if the same rose tint were combined with straw or primrose (Tint 16, Plate IV.), then the individuality of the separate colours would suffer, for, being similar in character, they would neutralize each other's attributes, and would impinge upon one another. Hence, if in colouring textiles, it is required to preserve the intrinsic attributes of a shade, it should be combined with such colours as will differ most decidedly from it in hue and other qualities; whereas, if it is sought to change, by the law of contrast, any particular shade, it should be brought into contiguity with potent colours more or less allied to it in tone and hue.

35. *Contrast*.—What is termed “contrast” is that principle or quality of tints which produces a change in their lustre, depth, saturation, and hue, when in immediate contact with each other.

Contrast may be explained by considering the effect of black and grey yarns in a woven style to which white is subsequently added. There is contrast in the pattern before the white is introduced, but it lacks precision and force. The addition of white imparts lustre to the grey, and fulness of tone to the black. Correctly speaking, neither the black nor the grey are changed by the white; they are, as it were, developed by it. White, in this instance, has the same function as in shaded drawings, in which clearness and boldness are given to form and outline by increasing the dark element of some parts and the light element of others. What may be designated a *Tempered Contrast*, originates when a quantity of grey intervenes in a mixture of black and white. In the shading of a round surface, this kind of contrast, in neutral tints, is developed to perfection, undue harshness of effect being neutralized by the gradual toning of black into white; but in the shading of angular objects, the sudden transitions from the extreme light to the extreme dark end of the scale of shades, produce good illustrations of the characteristics of *Decided Contrasts*. A pattern composed solely of black and white yarns is full of this kind of contrast, but by adding grey a toning element is introduced which forms a mellowed or tempered combina-



tion. Decided or "hard" contrasts, resulting from the use of positive (primary and secondary) colours, are exactly the reverse of graduated ones; they are inartistic, and deficient in softness which constitutes good colouring; on the other hand, toned contrasts possess richness and mellowness. Contrasts obtained by combining pure colours may be harsh and displeasing to the eye. Red and blue, for example, form a strong colour contrast, but this may be subdued by changing them to tones or tints. This will be seen by combining the following derivatives of these primaries: dark brown (Shade 1, Plate IV.) and dark blue (Shade 7, Plate IV.), and rose pink (Tint 5, Plate IV.) and blue lavender (Tint 11, Plate IV.). On account of the colours in these cases being either shades or tints, they produce mellow or tempered and not harsh or pronounced contrasts.

36. *Examples in Contrasts.*—On Plate VIII. and in Nos. 1 and 2, two illustrations in contrast are given. In No. 1 the two ground colours, pale blue and straw, form a passable contrast, but the small lines of orange impart harshness of effect to the stripe. The strength of hue of this colour is not suitable for the stripings on which it is placed. Providing only three colours were allowable in this composition, then to prevent the orange from being too pronounced, it should be softened or tempered as in the illustration, No. 2, Plate VIII. While in this latter example the pale blue and straw remain the same, yet the mellowing of the orange into a paler tint produces a strip of colouring in which each element, being of similar depth of tone, is equally prominent and effective. Comparing these illustrations further, it is obvious that in No. 1 the orange characteristic first strikes the eye. The slight hardness of tone does not arise from any want of beauty in the separate colours, but from the relative undue strength and vividness of the shade of orange. Providing this hue were replaced by green, an imperfect contrast would be formed; for green, while detracting from the lustre of the pale yellow or straw, would also harmonize indifferently with the lavender or tempered blue. From these illustrations it will be evident that in a satisfactory blend of colours all hues contribute to the attractiveness of the *ensemble*;

but in an imperfect contrast one or more colours may subtract from the lustre of adjacent hues, and partially neutralize their effect.

37. *Economic Contrasts.*—Economic Contrasts comprise the production of the most effective styles with a minimum variety of hues. It does not follow because a pattern contains a diversity of shades that it will be attractive. Just as it frequently happens that the most permanently beautiful patterns result from the simple but unique methods of amalgamating forms, so by the artistic arrangement of a few choice colours excellent contrasts may be produced. To multiply the diversity of hues in any combination without marked increase of beauty is calculated to be more detrimental than beneficial to the style. An economic method of colouring consists in blending shades or tints of the same colour, and freshening or brightening the style by the use of “extras” or “fancies.” To practise economy in colour compounds, the first care should always be to obtain appropriate ground shades: if these produce harmony and possess a rich though subdued bloom, but few bright colours will be necessary to impart freshness and lustre to the style. On the other hand, an indifferent selection of foundation shades implies the employment of an increased range of fancies to tone, strengthen, and brighten the contrasts.

38. *Two Kinds of Contrasts.*—All types of colour compounds may be included under two heads: namely, Mono-chromatic and Poly-chromatic Contrasts. The former comprise all species of contrasts due to a diversity of tint or shade in one colour; the latter comprise all kinds of contrasts arising from combining two or more distinct colours. The strongest and most effective colourings occur in poly-chromatic contrasts; while soft, subdued, and graduated tonings are largely characteristic of analogous colour contrasts. Blends of scarlet and green, yellow and blue, and orange and purple are colour couplets which illustrate the principles of contrast due to a diversity of hues; but blends of two shades of brown, blue, or slate, form contrasts belonging to the mono-chromatic class. In textile designing both these types of colouring obtain. They are frequently present in the same pattern, for a style may contain contrasts in shade, as well as

contrasts in hue. For example, if two shades of brown, forming the bulk of a pattern, are brightened by extra threads of scarlet and blue, its colour elements are a co-mixture of both kinds of contrasts defined above.

39. *Poly-chromatic Contrasts*.—A suggestive illustration of this species of colour arrangement is given on Plate VIII. in No. 3. It is a scrap of textile ornament, borrowed from a Japanese work on decorative fabrics found in a Buddhist temple. A more vigorous combination of colours, possessed of greater potency and lustre, it would be difficult to conceive. With such chromatic science have the various hues been associated that each retains, unaffected, its individual strength and vividness. Considering that this group of forms contains no fewer than seven colours, in addition to black and white, and that the ground shade is a deep purple, the lustre of the separate hues is exceptional and a forcible quality of the design. Purple, as a rule, is a shade that, in virtue of its potency, alters all colours with which it may be mingled that are in any way akin to it, such as greens, blues, and reds; but it forms strong and decided contrasts with yellow, orange, and their derivatives. It becomes, therefore, an interesting inquiry, why in this blend of hues, green and blue lose none of their freshness and saturation. The method of arranging the colours, or the plan of combination—comprising the couplets scarlet and orange, deep and pale greens, and deep and pale blues—supplemented by the ingenious touches of black and white, are elements at the base of the colour emphasis characterizing the entire pattern. For the purpose of making the sequent analysis as lucid and instructive as possible, one of the four triple-leaved conventional forms surrounding the central diamond figure may be isolated, and its colourings alone considered; for each of these not only comprises every kind of hue entering into the design, but also illustrates the system of colour-mingling adopted throughout the design. Starting with the minute spots of scarlet—they are contingent, on the one side, with the purple ground: and, on the other side, with the small curved strips of orange. If the eye is allowed to single out and rest upon these scarlet sections where they are in contiguity with the purple,

it will be noticed that the scarlet gains a crimsonish hue; but the eye takes simultaneous cognizance of the whole series of hues—a feature of the pattern which markedly contributes to the freshness of the individual colours. As a result of the incompetency of the eye to view the colours separately, and also on account of the method of arranging the colours, green at once associates itself in the mind of the observer with scarlet, and orange with pale green and deep blue. The law of contrasts brings the complementary colours in affinity, and, as a consequence, develops strength and fulness of hue. Impingement of colours is by this means avoided. The white edging of the leaves prevents the purple ground from affecting the purity of the pale blue, and also imparts clearness of outline to the ornament in general.

The lessons to be learnt from this colouring may be summarized as follows: First, pure complementary colours, when adjacent, do not neutralize, but develop the qualities of each other; second, that by an appropriate use of white and black, as agents for separating colours, kindred hues may be arranged to produce an attractive contrast; and third, a medium shade of green gives lustre to scarlet, and palish green and deepish blue are complementary to orange.

Some useful ideas may be gleaned from this example in Colour Contrasts for textile purposes. Thus, the small figures composed of the tints, as arranged in one of the conventionalized leaves of this design, may be grouped on a sateen system in a style for fancy vestings. It is suggestive in other ways. Ideas for cotton stripes or checks of a flannelette class may, for example, be obtained from it. Stripes of the blue shades here given, placed on a white ground, and brightened with a few threads of the orange hue, would form harmonious colouring. Again, a fabric of a dress-stuff description, in which the same arrangement of tints is observed, but the colours softened or tempered with black, could be appropriately coloured on this system. In such an instance scarlet would be replaced by dark brown (Shade 1, Plate IV.); orange by reddish olive (Shade 9, Plate VI.); medium green by deep green (Shade 2, Plate VI.); pale green by toned green (Shade 3, Plate VI.); blue by dark blue

(Shade 7, Plate IV.); and pale blue by toned blue (Shade 9, Plate IV.). It is evident from this group of shades that such a brilliant blend of hues as that composing the design given in No. 3, Plate VIII., may be turned to useful account; for in this instance it has been made to form the base of a new scheme of combining a number of dark colours adapted to a dress-stuff style. Of course it will be noticed that the modified colours are related in hue to the pure colours of the specimen of colour contrast considered; hence it follows that if the original colouring is characterized by balance of tone and harmony, the resultant blend of shades must possess similar qualities mellowed and tempered in intensity.

One further thought on this plan of colour-mingling should be alluded to. In the foregoing example in shade-deduction from a combination of bright hues, dark colours have been employed; but it is equally feasible to appropriate tints as follows: rose (Tint 6, Plate IV.) for scarlet; pinkish orange (Tint 11, Plate VI.) for orange; pale blue (Tint 11, Plate IV.) for blue; lavender (Tint 10, Plate IV.) for light blue; pale green (Tint 5, Plate VI.) for green; and very pale green (Tint 4, Plate VI.) for light green. This series of tints, when associated with suitable quantities of white, might be applied to textiles with satisfactory results, more especially if the system of grouping given in No. 3, Plate VIII., were adopted. Illustrations, based on this interesting specimen of colour amalgamation, have been multiplied because they indicate how useful "hints" in harmonious colouring may be gleaned from an apparently extravagant though elegant arrangement of hues.

40. *Mono-chromatic or Analogous Contrasts*.—This kind of colour contrast is extensively applied to all classes of decorative work. Nature abounds with suggestive illustrations of the principles of these colourings, a few of which may be described. Amongst flowers and plant forms which exhibit contrasts in reddish hues, the rose and stem of a forced rhubarb are particularly good. Take the rose first. What a beautiful delicate series of red tints it contains, and how mellow and rich are its finely graduated tones! There is an entire absence of harshness or even tendency to hardness of tinting in its

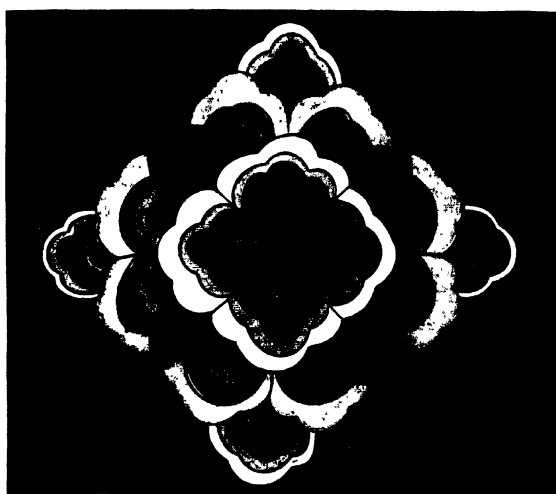


Plate VIII  
 EXAMPLES IN COLOUR CONTRASTS  
 1, 2. Stripes. 3. Figuring in Bright Colours



colour composition. Ruskin, writing on gradation of hues, observes: "The victorious beauty of the rose as compared with other flowers depends wholly on the delicacy and quantity of its colour-gradations, all other flowers being either less rich in gradation, not having so many folds of leaf, or less tender, being patched and veined instead of flushed." A stem of rhubarb also contains an infinite variety of gradations of crimson. At the base, it commences with a saturated crimson which alters in intensity to a palish pink. Not only are examples in red contrasts discovered in natural forms, but also shadings and tintings of green, blue, and brown. In the flimsy, delicate petals of the harebell several gradations of blue occur, running from a deep to a palish tint. For browns, the foliage of autumn only need be referred to. The leaves teem with diversity of shade, yet all the colours are of a brownish cast, varying from bright tan to rich russet. Some species of sandstone and pebbles exhibit useful gradations of fawn, such as cool and warm colours, especially suitable for application to textile patterns.

The chief characteristics of graduated contrasts—which compose a large variety of colourings in decorative design—are softness and mellowness of toning, combined with lustre and force of effect. Compared with hue contrasts, they may lack strength and precision of emphasis, but they possess a soft, saturated fulness which makes them useful in the production of fancy textures.

41. *Toned and Tinted Contrasts.*—Mono-chromatic compositions may be considered under two varieties, namely, Toned and Tinted Contrasts. The former comprise all associations of shades in which the colours have been toned or darkened by admixture with black; while the latter are composed solely of colours which have been tinted with white. These contrasts comprise the most valuable assortments of colours seen in fabrics produced for wearing purposes. Their quiet and mellow toning makes them of great utility in textile designing. Probably the largest proportion of fancy textures manufactured for men's wear, results from this sort of colour composition.

Illustrations in this type of colouring deserve to be carefully considered. The first example which will be alluded to is



on Plate IX., No. 1. It is a toned contrast, being a mixture of the three browns, Shades 1, 2, and 3 on Plate IV. The style is suitable for either woollen or worsted materials, and is of a check description. The mode of sketching shows the effect due to the simple twilled weave used in its construction, as well as the peculiar form of check resulting from the plan of blending the shades. But it is the colour element of this fabric, with its gradated contrasts, that is at this stage most important. The three shades of brown have been combined thus in both warp and weft: 8 threads of dark brown, 8 threads of medium brown, 8 threads of light brown, and 8 threads of medium brown. The medium shade thus alternates with the dark and light colours, maintaining one depth of contrast throughout the pattern. Blues (Shades 7, 8, and 9, Plate IV.), greens (Shades 1, 2, and 3, Plate VI.), or olives (Shades 7, 8, and 9, Plate VI.) might have been selected with similar results as the browns of this illustration. Three greys would also have shown the principle of this type of contrast, for compositions of dark, medium, and light greys form an endless diversity of textile patterns. But to return to this brown example. The contrast is of a mellow kind. There is no marked distinction between the shades, the three composing a softly-toned coloured effect. This characteristic of the style is of course attributable to the several shades being derivatives of the same hue—the red element predominating in each. Whatever kind of shaded or tinted contrasts are considered, they are characterized by the same tone of colouring seen in this pattern.

In order to show the precise nature of this class of contrast in tints instead of shades, another illustration is that in No. 2 on Plate IX., composed in this instance of three lilac tints similar to those given in Nos. 16, 17, and 18, on Plate VI. Again, the plan of the weave of the fabric is cassimere twill, but the system of colouring has been diversified; thus, it consists of 16 threads of the deep tint, 8 threads of the medium tint, 16 threads of the light tint, and 8 threads of the medium tint. While this arrangement forms a somewhat more varied style than the preceding method of combination, the tints of which it is composed are distributed in equal quantities, producing a

uniform colouring. Its quality of mellowness is even more pronounced than that of No. 1. Being a light pattern, it possesses a unique delicacy of toning. This applies to all compositions of tints, which, when properly graduated, constitute the most mellow type of colouring producible.

These illustrations in Toned and Tinted Contrasts are typical of the general effects obtainable by combining colours of the same hue but of different degrees of lightness and shade; they show that while effective compositions may be acquired with shades or tints, yet they are usually deficient in that force of contrast characterizing patterns containing a variety of hues.

42. *Comparison of Contrasts by Shade and Contrasts by Colour.*—Relatively considered, contrasts in several colours are more definite and brilliant than contrasts in shades or tints; hence the former are applied to all classes of decorative fabrics, while the latter constitute the bulk of the colouring in textures made for wearing purposes. Of course, both systems of colouring largely overlap each other, making it impossible to limit the classes of fabrics in which each finds expression; still, in the general run of styles, tempered colours are the most appropriate for the ground or foundation of wearable textures; while, on the other hand, bright and positive colours impart the most telling precision to ornamental forms. Hence it may be affirmed to be a common law in textile colouring, that shades and tints compose a large proportion of styles intended for garments, whereas the special province of hue contrasts is in the development of figured designs. Tartan checks or plaids (see Plates V. and X.) are amongst the principal exceptions to this rule.

43. *Shaded and Tinted Compositions.*—These may either result from the use of one or more colours. First, suppose an instance in which blue shades are combined with blue tints, or in which the same hue prevails throughout the whole of the colouring. Thus, take the three shades given in Nos. 7, 8, and 9, and combine them to form a striped pattern with the three tints, Nos. 10, 11, and 12, on Plate IV. Providing they are arranged in the order here mapped out, they would constitute a perfectly toned shade of blue. The gradations would run from a deep shade to a light tint, or from an extreme dark to an

extreme light blue. An idea of how shaded patterns are arrived at in woven textures, in one hue of colour, may be gleaned from this example, for it is evident from the elements of its arrangement that a shaded effect may be produced in all kinds of hues, such as brown, olive, and green, if they are capable of yielding a sufficient diversity of toning.

But, in addition to this method of associating tints and shades, these colour derivatives are also combined in distinct hues, forming a varied assortment of colourings. A ground pattern, for example, consists solely of an arrangement of shades; but, in order to give brightness to the style, a few fancy threads of tints derived from other hues—possibly of opposite, or may be of complementary, qualities to those from which the shades have originated—may be called into requisition. This principle of colouring may be clearly demonstrated by referring to the brown check pattern given in No. 1, Plate IX. To impart a degree of freshness to this design, blue tinted threads might be employed, say about two between each shade. Exactly the same tint should not be introduced between the checks of the several shades. For the darkest shade the deepest tint should be used, for the medium shade the medium tint, and for the light shade the light tint; in other terms, whatever the nature of the shade, a corresponding tint is requisite. Balance of colouring and of contrast is only attainable by strict adherence to this rule. If the same tint were used for all the shades, it would appear stronger and more pronounced in some sections of the pattern than others. The blue tint which produces exactly the desired contrast when associated with the light brown of this pattern, would have a very different effect if placed on the dark brown: so that in applying tints to a good blend of shades, or shades to a good blend of tints, to secure diversity and freshness of pattern, combined with uniformity of contrast, care must be exercised in the selection and appropriation of these fancy or brightening elements, otherwise they are likely to prove more or less effective in some instances than calculated, and to destroy the harmony of the whole colouring.

The methods of acquiring Colour Contrasts, by combining tints and shades may be summarized as below: I. Compositions

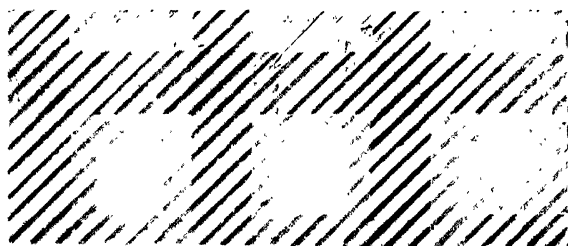


Plate IX

MONO-CHROMATIC CONTRASTS

1. Contrasts in Tones
2. .. .. Tints



of several Shades or Tones of the same Hue;<sup>1</sup> II. Compositions of several Tints of the same Hue;<sup>1</sup> III. Compositions of Shades of different Hues; IV. Compositions of Tints of different Hues; V. Compositions of Shades and Tints of the same Hue; and VI. Compositions of Shades and Tints of different Hues.

44. *Bright Colour Contrasts Modified with Black and White.*

—Some elaborate check patterns for dress and other materials consist of bright colours. An example of this type of contrast is supplied on Plate X. The colouring is harmonious and choice; showing that the most potent colours may be used in textiles with satisfactory results.

However this pattern is examined, it is lustrous and rich in composition. Possibly the black and white introduced into the texture mellow and soften the general colouring, for they undoubtedly subdue the strength of the contrast arising from three such positive hues being in immediate affinity with each other. It is already understood that these shades are of great utility as mellowing agents when combined with bright colours. They prevent the sharp contrast which sometimes ensues when several lustrous hues are in close proximity with each other. Blue and red in certain forms constitute a harmful contrast, the two producing anything but delicate harmony. Vigorous as the contrast is, in this instance it is not harsh or defective. There are several elements which are conducive to its harmony. First, there are the black and white threads just alluded to; second, the quantities in which the several colours are associated; and third, the peculiar effect due to the plan of interlacing the warp and weft threads in the construction of the texture. Weaving largely multiplies the effects due to a combination of colours, as is instanced by this pattern, which, though only comprising four distinct colours, and white and black, contains many varieties of colouring. These result from the different colours crossing and blending with each other in the formation of the check. At intervals, the scarlet weft covers the scarlet, blue, green, yellow, white and black warp yarns, producing a specific effect in every transition. Analysis shows the various effects to comprise solid checks of red, green, blue, yellow, black, and

<sup>1</sup> *Analogous Colours.*

white; and mingled checks of the following shade couplets: blue and red; yellow and red; green and red; blue and yellow; blue and black; blue and white; red and black; red and white; yellow and black; yellow and white; and black and white. What a variety of lessons in colouring such a woven sample teaches! The black and white on the red adds mellowness to this bright colour, in addition to giving diversity of effect. The white in other sections in contiguity with the medium green, and crossing the yellow, has a like toning quality. The black against the yellow enhances its brightness, but in juxtaposition with the blue forms a soft shading, the latter making a clear definition of colour with the shaded green effect to which it is adjacent.

The quantities or proportions in which these colours are distributed in the pattern should be observed. Any increase or even variation in the quantities of each colour would produce a different harmony of composition. Regard must, therefore, be paid to the nature and potency of colours in determining their scheme of association in textile design.

45. *Successive and Simultaneous Colour Effects*.—In the above pattern, both successive and simultaneous contrasts are found. A simultaneous contrast is a blend or group of colours in which the several hues are in proximity. The intermingled checks of red and blue, yellow and blue, etc., are all illustrative of this type of contrast. In successive contrasts, there may be the same colours, but instead of being in juxtaposition they are separated; and, consequently, do not act in perfect unison on the eye, but each independently.

Comparison of the results of these contrasts shows, that colours suffer the most in lustre and purity of hue when in "simultaneous" association. Several examples of this kind occur in the pattern given. For instance, in those sections in which the red and green are intermingled in equal proportions, both colours undergo an apparent change in hue. In reality, it is simply the fundamental law of all colour contrasts asserting its influence on the colouring as a whole, whereby each hue is modified.

Amongst some of the most salient principles of textile colouring emphasized by this design that should be specially noticed, are these: Colours are modified the most largely in hue when in

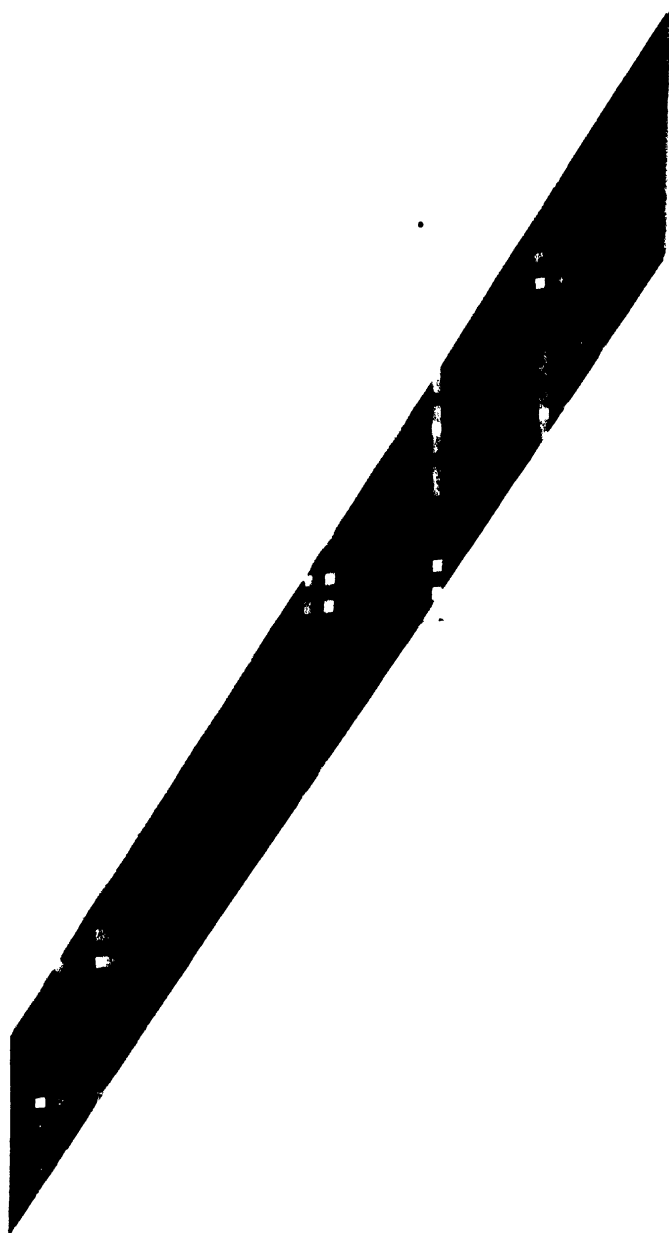
actual contact; the stronger two or more colours, the less are they changed by simultaneous contrast; bright colours on a dark ground increase in luminosity, but are impoverished if applied to light grounds; and lastly, that intense colours gain in saturation on light grounds, but suffer in this quality on medium and dark surfaces.

46. *Methods of Neutralizing the Effects of Strong Colour Contrasts.*—It has been pointed out that when any positive colours are in immediate proximity, each suffers somewhat in purity of hue. To obviate, or partially neutralize, this sequence of colour association, some ingenious methods and technical devices are adopted.\* As already explained, colours change the most in hue by juxtaposition, so that the object to be attained is to separate them without bringing the divisional lines into prominence. It is not always feasible, in figured and fancy fabrics, to have the colours detached; they frequently intermingle, and it is at the points of actual contact where the skill of the colourist in obviating a defective contrast, due to the proximity of two or more brilliant hues, is exercised. No. 1, Plate XI., illustrates this feature of colouring. This pattern is composed of red and blue, and contains small quantities of a third hue which are of value to the harmony and contrast of the design. If the red had been allowed to actually touch the blue ground, the figuring would have lacked precision, and the colouring congruity of toning. Moreover, as green is the contrasting colour of scarlet, it has developed the figuring, and mellowed the effect of red on this deep blue ground. Minus this intermediate colour, the contrast would have been harsh, if not defective; but by its employment richness has been given to the red and softness of tone to the blue. Let it be supposed that red and blue were substituted in succession by green and tan (Shades 6, Plate VI., and 3, Plate IV.); by olive and rose (Shade 15, and Tint 5, Plate IV.); and by lilac and primrose (Tint 16, Plate VI., and Tint 16, Plate IV.). Tan, rose, and primrose to compose the figuring, and green, olive, and lilac the ground in the new colourings. Now, in order to prevent impingement of hues, divisional colours to take the place of the green in the illustration should be selected, which, while contrasting with the several hues employed for the figuring,



should also harmonize with the ground colours. For the first couplet, the pale blue (Tint 10, Plate IV.) may be used; for the olive and rose combination, pea-green (Tint 4, Plate VI.); while for the lilac and rose blend, the salmon in Tint 11, Plate VI., will be found useful. In each of these instances there is harmony and contrast of colours, which would prominently develop the figured sections of the design. To show these results, paint two pieces of paper similar in hue to Shades 6, Plate VI., and 3, Plate IV. Having done this, place the tan sample—which should be smaller than its companion—on the green slip, and then surround it with a narrow slip of rose, Tint 4 of Plate IV. On adding this last colour, a tasteful contrast will be formed by the green spot and the rose edging; and also soft, mellow harmony produced by this tint and the tan groundwork. Should each of the colourings alluded to be similarly experimented with, they would constitute equally pleasing combinations. As important principles underlie this kind of colour arrangement, it is advisable that numerous experiments of this class should be made by the reader; for, in order to educate the eye for colour contrast and harmony, practice in the combination of hues is essential.

47. *Harmony*.—Some colourists have propounded theories of harmony which are quite untenable in practice. For example, one scheme is based on the supposition that if the primaries are blended in the proportions of 3 parts of red, 5 parts of yellow, and 8 parts of blue, harmony of composition ensues. There can be no doubt that the ratio of quantities materially affects the congruity of tone of all shade assortments; but in designing it is not feasible to work to any set of proportions. Colour harmonies are not to be acquired by rigid adherence to a mathematical system of arrangement. Theories of this kind cannot be said to be of much technical value. Acute and cultured discriminative power for colour is of more consequence in this art than theoretical directions; the acquirement of what Rood calls “a delicate colour emphasis” is difficult even when there is natural aptitude for colouring. Systematic study of the works of designers of acknowledged capacity, and of all accessible rare and well-coloured woven specimens in harmony of tinting, should be



• Plate X  
SPECIMEN OF BRIGHT COLOURING IN PLAIDS  
•



made. Adopting this course, the student will acquire a ready capacity for blending hues by such methods, as to compose choice and harmonious results.

48. *Principles of Harmony*.—Though Colour Harmony is intricate, and more or less incapable of being reduced to rigid principles, yet its general qualities may be clearly defined. For instance, certain colours when amalgamated fail to produce congruous patterns; whereas other colours invariably constitute harmonious compositions.

Harmony, moreover, is only attainable when the several colours are combined in such proportionate quantities, and on such principles of shade-association, that each hue employed will conduce to the mellowness of the whole pattern. Should any colour be conspicuous, it is sufficient to detract from the harmony of the entire colouring. Balance of hues is an important essential; and it is generally a feature dependent on the proportions in which the several colours are combined. Examine, for example, the blue-green and scarlet check on Plate XI., No. 2.\* Red is so much more potent than green, that when these two hues are associated in the same pattern, the former requires to be used less extensively than the latter. The common rule is that those colours which are the intensest and strongest in hue should be sparingly employed. When the various shades are of equal depth, the quantities may be more uniform, being only varied to such an extent as to impart precision to the leading features of the design.

Apart from hints that may be given in harmonious colouring, and knowledge that may be acquired by study and experiment in blending hues, in order to excel in this art the designer must possess natural aptitude for the work.

## CHAPTER IV.

### COLOUR STANDARDIZATION.

49. Objects of Standardization in Colouring—50. Systems of Colour Standardization—51. Standardization by Selected Colours—52. Analysis of Standardization Scheme, Plate XII.—53. Use of Standards in Blending—54. Applications of the Scheme.

49. *Objects of Standardization in Colouring.*—There are several difficulties in formulating a scheme of colour standardization applicable to any particular branch of woven design. This arises, firstly, from the tone of colouring which obtains in decorative, dress, suiting, and other fabrics. The manufacturer of each of these styles of textures should select standards of different degrees of brightness. In the second place, the colourist must have free scope—he should not on any account be fettered—in his work. Standardization may appear to impose restrictions. But on considering the several branches of textiles, it is obvious that certain elemental ranges of shades are mainly used in the several departments of woven manufactures, as, for example, in fabrics for men's wear, women's wear, decorative and other purposes. This not only suggests the possibility, but renders it feasible—without placing limitation upon the origina-tive faculty of the designer—of adopting in practice a standard set or series of selected colours from which other shades may, by the process of blending, be acquired.

This may be done with the object of (1) economy of colour production, a limited set of colours yielding an unlimited set of distinct shades; (2) the substitution of uncertainty of "colour" or "shade" due to independent dyeings, by certainty of result due to mixing; and (3) the manufacture of yarns by blending from a set of fixed colours which may be stocked, producing new shades as varied and solid in appearance as those obtainable in dyeing.

In the ordinary method of obtaining new shades by blending, there is an absence of a scale of fixed colours; neither in the blending is there a base of proportions, nor in the colours combined a standard scheme of colour gradation. But in standardization there is a distinct range of colours, each of which is toned or graded to the same degree.

50. *Systems of Colour Standardization.* — There are two systems on which Colour Standardization may be effected, namely, (1) the primaries, secondaries, and tertiaries may be adopted as the initial colours; and (2) a series of initial colours may be determined upon, each colour being graded from light to dark, and forming a number of intermediate shades between the two extremes.

Defining the first system, the Primary and Secondary colours have each three distinctive hues, that is, the pure or spectrum hue, and the two obtained by modification.

Red, tinged with blue, forms crimson.

" " " yellow, " scarlet.

Yellow, tinged with red, becomes slightly orange in tone.

" " " blue, " green " "

Blue, tinged with red, " purple " "

" " " yellow, " green " "

thus changing the hue, but to such a small degree that the original colour predominates.

The Secondaries and Tertiaries are subjective to similar changes without eliminating the definite or spectrum colour.<sup>1</sup>

On this principle, eighteen base colours are obtained, all of which, by the addition of white in variable quantities, may form a series of tints, and by the addition of black, a series of tones; or they may be softened in brilliancy by the addition of neutral grey.

In such a scheme, it would probably only be found desirable to modify the Tertiaries by mixing with black and white respectively.

The question of the brilliance of the initial colours is one that has to be fixed according to the application of the scheme. To mix pure white with the colours described would give, in many instances, useful tints for the dress and decorative trades, and also, if mixed with black, suitable tones for the same fabrics;

<sup>1</sup> See also Pars. 8 and 9.

but for ordinary textile purposes the pure elemental colours are too bright. These would require to be dulled or subdued by adding neutral grey to a definite scale of gradation.

51. *Standardization by Selected Colours.*—The second method of Standardization consists, as stated, in selecting a series of recognized workable colours and graduating them to six or more degrees. The principal colours are blue, green, and brown, with the addition of blue green, olive, and heliotrope, or colours which, with their gradations, are generally found most appropriate in fabrics for wearing purposes. (See series A to J, Plate XII.)

Having fixed upon the initial colour in each set, the question of toning or gradation is all-important. A uniform scale of gradation must be adhered to in each group. If this is departed from, mixing would result in a want of balance of gradation.

The base for the standard series of tones and tints are neutral greys (see Plate XII.). Here the mixing of black and white may be made to give ten or twelve or more tones with similar degrees of difference. A scheme of gradation formed in this way is applicable to any type of blend composed of a dark and a light shade, corresponding to black and white in the grey. Between the two extreme colours, several shades may be introduced, and yet uniform toning maintained; for whichever series of colours is selected, it will be seen that the movement from a dark shade to a lighter, in any part of the series, is correct as to depth and tone. This must be an absolute law in mixing the same number of colours in any series, or any group, providing that the scale of tones has been accurately produced in each kind of colour.

52. *Analysis of Standardization Scheme, Plate XII.*—The chart contains in specimens 1 to 6, series A to J, the simple or dyed colours which have been selected as the base or scale standards. These are varied in two ways, the specimens 7 and 8 being tinted with white, and 9 and 10 toned with black in the following proportions:—

Tint No. 7,	5 per cent.,	Standard No. 1.
95.	„	White.
Tint No. 8,	60	„ Standard No. 1.
40	„	White.

Tone No. 9, 40 per cent., Standard No. 6.

60 „ Black.

Tone No. 10, 5 „ Standard No. 6.

95 „ Black.

These tints and tones could be carried out to six in each, when suitable proportions would be as follows:—

Tints	{ Colour . . .	5	20	40	60	80	95
	{ White . . .	95	80	60	40	20	5
Tones	{ Colour . . .	95	80	60	40	20	5
	{ Black . . .	5	20	40	60	80	95

In the second method, the colours are blended crossways in equal proportions. No. 1, Series A, and No. 1, Series B, give No. 1, *Xa*, *Xb*, etc. Similarly, No. 1, Series B, and No. 1, Series C, equal No. 1, *Xb*, so that whether blending shades in each series, 1 A, 2 A, etc., or blending two shades in adjacent series, 1 A, 1 B, etc., that is two shades of the same colour in the former, and two shades of contiguous colours in the latter, for practical purposes, solid shades would be acquired.

The chromatic scale is compiled as follows:—

- |                  |                  |
|------------------|------------------|
| • A. Blue.       | F. Yellow brown. |
| B. Green blue.   | G. Brown.        |
| C. Blue green.   | H. Red brown.    |
| D. Green.        | I. Purple.       |
| E. Yellow green. | J. Red blue.     |

It will be observed that there is no such decided change in hue or tone between any two adjacent colours as to produce, when mingled in equal quantities, an apparent mixture. This is an important elemental feature of any scheme of Colour Standardization—the several colours must be accurately graded. If, for example, any two shades are too far apart in the chromatic scale, the blending of them would produce a mixture effect. In other words, if the difference in tone or the difference in hue is pronounced, mixtures and not solid shades are formed.

53. *Use of Standards in Blending.*—In both the Woollen and Worsted trades, blending is an important department of yarn manufacture. Solid shades are obtainable in piece-dyes, but



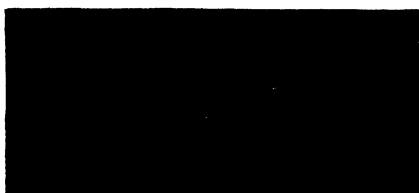
mixtures have to be acquired by the blending of coloured materials. The designer and colourist has resource to the combination of colour units in the blending of fibres in the production of shades and mixtures possessing novelty of tone. In this task he has two considerations: (1) the choice of the separate or distinct colours which, prior to blending, must form, in juxtaposition, harmony and contrast; and (2) the proportionate quantities in which they are to be combined. The latter, as every colourist has proved, may destroy the value of the former. Much of the success of colouring, whether in the material or the yarn, depends upon the relative weight, intensity, and proportions in which the colours are united. Now, when a scheme of standardization has been formed, and is used, the proportionate parts or quantities are according to a fixed mathematical scale, but the discovery of the correct colours to blend according to any series of these proportions is left to the trained faculty of the designer or expert, who must have regard to the fabrics and style of design to which they are to be applied.

The proportionate scale which is used does not affect the latitude for the exercise of the faculty for colour combination, but rather presents conditions which are so varied and yet definable, as to give a certainty of result as to depth and nature of colouring due to the process of blending.

There are two great principles on which the art of Colour Blending in the raw materials is accomplished, namely—

- (1) The origination of blends or mixtures in which tone gradation is practised.
- (2) The origination of mixtures composed of several Colours to produce different hues or shades, but these to be of the same weight or tone.

In both, it is a problem of how the colour modification is to be attained. From the explanation given, it is obvious that in the first principle of blending, a fixed scale of proportions may be practised, so that the real essence of the work consists in selecting colours which harmonize with each other and coincide with the proportions adopted; or, in other words, the relative contrasts of colour must be in accordance with the relative proportions. That is to say, if a bright colour, though harmonizing with other



1



2

**Plate XI**  
**RED, GREEN AND BLUE COLOURING**

1. Figured Pattern
2. Check ..



colours in the mixture, is used in too large a measure, the mixture will be unsatisfactory.

54. *Applications of the Scheme.*—In this scheme there is ample scope for the colouring of many classes of woven fabrics. Bright or brilliant hues would be added as required. The scheme is, however, sufficiently complete for the ordinary styles of woollen, worsted, and other classes of fabrics. For costumes, vestings, cottons, and silks, richer colours would be desirable. If, for example, the principle of colouring was in relation to cottons and silks, then the "tints" of the standards would be found chiefly applicable, white and light grounds being mainly used; on the other hand, for fabrics with dark or medium grounds, the "tones" of the standards would be selected.

This standard scheme of colours, systematically toned, forms a practical workable base of colouring, one which, in the first place, in the use of the pure colours, makes it feasible, in the production of patterns, to obtain (*a*) ranges in which the contrast of colour in each pattern is absolutely uniform, and (*b*) ranges in which there may be perfect gradation from the dark to a light shade, and yet the same quality of contrast of colour in each pattern in the range.

In the second place, the scheme provides, by the mixture with black, grey, and white in succession, a means of acquiring a wide range of mixtures, each series of which runs by natural and constant degrees from a comparatively light to a dark result.

Third, it is possible by this system, in blending two or more colours, to acquire (*a*) graded series of mixtures of exactly corresponding depths of tone; and (*b*) varieties of mixtures in light, medium, and dark shades of similar depth of tone, but of different hues.

And lastly, the system is applicable to the production of distinct colours, such as would possess similar qualities to colours dyed in the wool, yarn, or piece.

## CHAPTER V.

### MIXTURES.

55. Varieties of Mixture Patterns—56. Elements of Mixture Colouring—57. Importance of Pure Materials—58. Several Classes of Mixtures Compared—59. Simple Blends—60. Blends of Wools and Pigments Compared—61. Modes of Testing Compositions of Colours—62. Mixtures composed of Two Shades—63. Compounds of Two Colours in which White is used—64. Illustrations in Mixtures composed of White and a Second Colour—65. Mixtures composed of Black and another Colour—66. Grey Mixtures—67. Bloomed Greys—68. Coloured Greys—69. Two-Coloured Mixtures—70. Multi-Shade Mixtures—71. Twist-Yarn Mixtures—72. Marls—73. Weave Mixtures.

55. *Varieties of Mixture Patterns.*—There are five methods of making mixture patterns, namely, (a) by carding several colours of fibrous materials together, producing *mixture woollen yarns*; (b) by combining in the process of *drawing* two or more slivers of different colours, producing *mixture worsted yarns*; (c) by combining in the process of *roving* two or more slivers of different colours, producing "*marl*" *worsted yarns*; (d) by using fancy yarns; and (e) by mixing two or more classes of threads in the weaving process. Each system is extensively practised; but the most intermingled effects ensue from blending the various coloured elements in the fibrous form. This system of producing mixtures yields a yarn in which the separate particles of colour, however diverse, are uniformly distributed throughout its length. Carding affords every facility for obtaining a softly toned blend, or one in which the filaments of distinct colours are perfectly mixed and intermingled. The shades are, as it were, united in this instance in the powdered or most minute particled form possible in textile compositions; whereas the methods of combining twist yarns, and of weaving shades of distinct colours together to compose mixture effects, consist of blending com-

paratively larger particles of colours. Perfect promiscuity, as a consequence, characterizes mixtures produced in the willowing and carding processes. These compositions are also distinguished by softness and mellowness of tone, entirely foreign to corresponding effects got by other methods. So completely are the elements associated on this system, that if blue and yellow wools were compounded they would constitute a green mixture, not so pure, however, as if pigments were amalgamated, for reasons alluded to in the sequel, but still they form a suggestion of this process of combination. If the same colours were united in the yarn state, even in the form of twist threads, they would still appear as separate hues; in other words, the yellow would remain yellow, and the blue would remain blue. To borrow an illustration, these methods of compounding fragments of colours in the manufacture of so-called mixture patterns may be compared with chemical and mechanical mixtures of substances; for just as in the former the bodies unite to compose a third substance, and in the latter they are mixed but not changed, so in blending colours in the fibre the mixing may be so complete as to yield an additional shade, but in blending them in the thread each hue retains its individuality. Twist-yarn mixtures possess a motley appearance of a broader character than those of blends in the wool or material, but still the richness of intermingling of tints is not wanting. In self-coloured yarn patterns of a mixture class the patchy character and detachment of individual colours are increased, while the mellowness and toned softness of the composition are diminished.

56. *Elements of Mixture Colouring.*—All mixtures require mellow treatment as to colour constituents. Patterns of this order should not be characterized by a patchy, but by a tinted appearance; every hue employed should be useful in composing an indefinite series of minute and closely mingled colour effects. To produce such styles no single hue should be allowed to obtain greater distinction or more prominence than other adjacent colours. Bright colours like red, crimson, blue, and yellow, seldom require to be used in large quantities. Black and white, browns, tans, medium blues, medium greens, olives, and other toned and tinted colours, form the main colouring of mixture

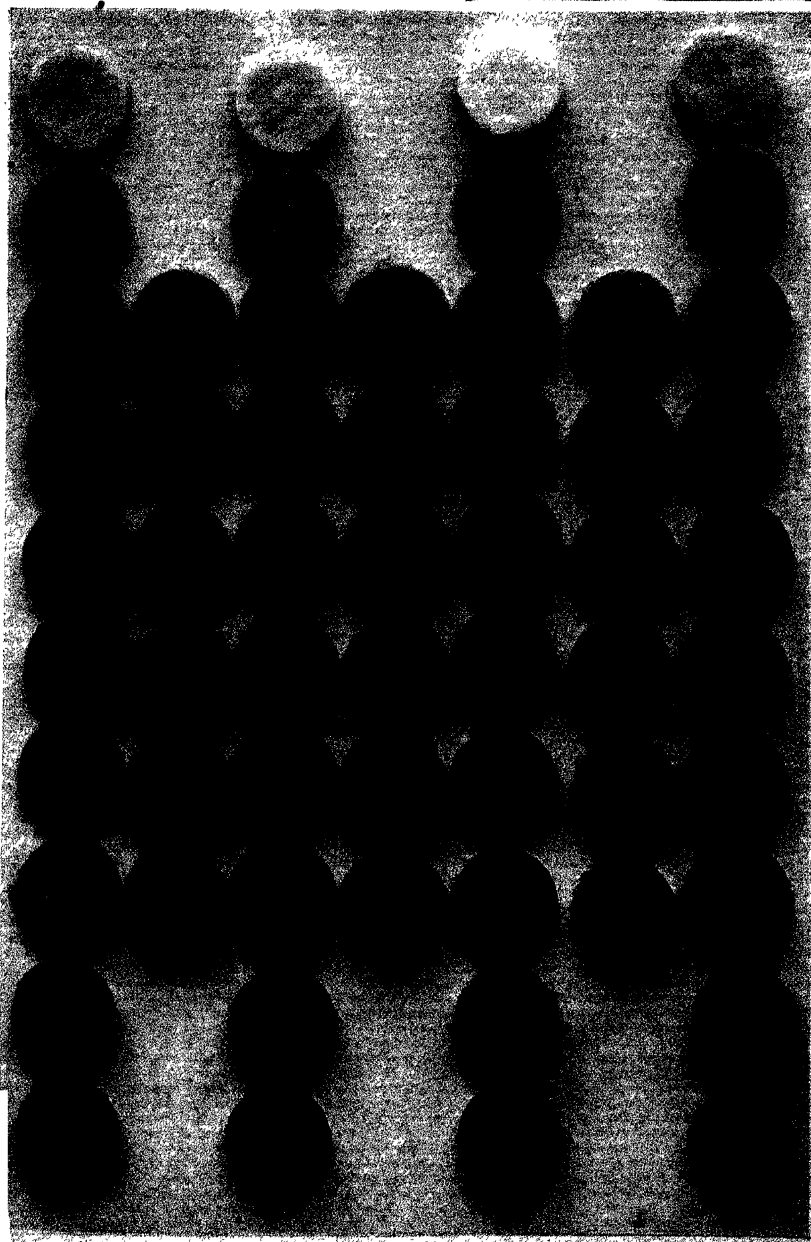
compositions: the more potent hues find a province in enriching and imparting lustre into these patterns.

The principal colours should generally be of a tempered type; still, it is important to use bright and decided hues. Murky, dull, and insipid shades should be avoided, as they are only capable of yielding dingy effects. The fragmentary nature of mixture colourings largely affects the lustre of the pattern resultant. Two colours which, when combined in large quantities, may possess congruous attributes, on being broken up into particles and intermingled lose lustre. In blending colours in the natural state, the separate hues are distinguishable after carding, for each, in the carded silver, helps to constitute quite a new and additional shade. If, for example, claret, fawn, and bright orange wools, in quantities of four parts of claret and one part of fawn and one part of the orange were scribbled together, neither the orange, fawn, nor claret would in the resulting "blend" possess precisely its original hue. Traces of each would be noticeable, but a species of indefinite drabish-brown mixture, streaked with filaments of orange, would be the composition obtained.

*57. Importance of Pure Materials.* — Bright and lustrous mixtures can only be secured by using pure wools. Such colourings are not feasible in the low materials used in making some classes of woven goods. Scotch mixtures will always excel in brilliant tinting so long as fibres of a mungo, shoddy, and extract class are rejected by manufacturers north of the Tweed. Having a good foundation to work upon—a fibre that will not only take a vivid colour but retain it—Scotch textures, notably Bannockburn and heather mixtures, are unsurpassed in lustre and mellowness of toning. Mixtures made in centres of the low woollen industry are not comparable with them as regards freshness of colouring. Of course, a passable imitation of the pure wool production is made, but the fabric lacks not only bloom and fulness of colouring, but quality and softness of handle. How is it feasible to get these elements of good mixtures developed to the same degree in these inferior articles, made of materials which in some instances have been utilized time after time in made-up garments, and as frequently ground up or reduced to filaments, scribbled, spun into yarn, and woven into a market-

Shade G - Brown XH Shade H - Red Brown XI Shade I - Purple XJ Shade J - Warm Blue

*Intermediate Shades produced by mixing the  
standard shades A<sub>1</sub> and B<sub>1</sub>, A<sub>2</sub> and B<sub>2</sub>, etc.*







able fabric, as are obtainable in the genuine woollen texture? If mixtures bright in colouring are to be acquired, resource must be had to wools of a sound quality. Stress is laid upon these points because they lie at the basis of good colouring in mixture styles; and also on account of the necessarily futile attempts made by some manufacturers to secure corresponding richness of composition in a mungo, or partially mungo production, as characterizes an all-wool article, which it is important to understand is totally impossible, for the simple fact that the better the raw material, the more lustrous the coloured effects secured.

58. *Several Classes of Mixtures Compared.*—The diversity of mixtures, acquired by blending several shades of fibres, is very large, comprising an infinite range of light, medium, and dark effects, in both woollen and worsted fabrics. There is, however, one quality characteristic of every species of this type of mixtures, namely, a rich, mottled aspect of colouring. Whether considered in the fibrous state or in the woven fabric, this mingled but continuous poly-tinted appearance is noticeable. Where the separate hues occur, and are lost to view, or how numerous they are, it is only possible to determine after careful examination. All the hues are scattered equally throughout the mixture, hence the blend in every part possesses similar qualities of bloom and diversity of tinting. These mixtures may be distinguished from those obtained by other processes, by the manner in which the various colourings are intermingled.

If a mixture fabric made on this system were compared, by analysis, with one got by using twist yarns, or by threads of divers colours in both warp and weft, some interesting results would be obtained. To dissect a mixture fabric produced by "blending," the yarns of which the texture is composed would require to be reduced to the original filaments. The proportions in which the colours are combined, are far more difficult to arrive at than the nature of their hues. Having by this method secured the exact colour elements, some data has been discovered upon which to base experiments, which, if properly conducted, will lead to the determination of the quantities in which the colours have been combined in the production of the composition. Ordinary twist-yarn mixtures do not offer so many difficulties

to the analyzer. First, as to their colour constitution: this is easy to discover if the different kinds of threads are classified, which can be done by unravelling the texture. Next, ascertain the colour composition of each by untwining the twists or separating the threads used in their construction. By adopting this system of analysis, both the exact hue of the colours and the quantities in which they have been combined may be obtained. The reason why the routine of dissection is, in this case, comparatively simple, is because the coloured factors of the fabric may be feasibly separated, whereas in the preceding class of mixtures the isolation of the various hues of the filaments employed is more difficult to effect. To discover the composition of a mixture in which self-coloured yarns have been used, it is only necessary to ascertain the methods of warping and wefting, or the plan of combining the yarns in the production of the fabric. Evidently, in these two last styles of mixtures, exact analysis of the colourings, both as to quantities and hues, is quite feasible, but in the first kind the proportions, as well as the precise colours, are difficult to acquire.

59. *Simple Blends*.—The most economical species of mixtures belonging to this class is that obtained by combining any one colour with white. Mixtures of this kind may be defined as tinted wools, for the process of production exactly coincides with that of forming tints with pigments. They differ, however, from the latter in appearance. A tint obtained by mixing red with white, for example, constitutes quite an even surface of pink; but mix white and red wools in similar quantities, and something more than a rose compound is produced, namely, a mottled, intermingled colouring, whether seen in the material, yarn, or piece. Equal quantities of blue and white, green and white, and orange and white wools, all form colourings streaked with their composing hues. It will be evident that this class of colour amalgamation opens up a wide field for investigation. First, there is the range of colours with which white may be associated, comprising both positive and tempered hues of a primary, secondary, and tertiary character. Second, there is the considerable diversity of proportions in which the elements forming the mixtures may be combined; for either the white

or colour may preponderate, or the two shades may be equally mixed. In addition to these mixtures, which are of the most elementary class, there are those resulting from blending black with other colours, and from compounding materials of two or more colours. The two former kinds are utilized in the manufacture of yarns for serge dress textures, for which fabrics they are particularly well adapted. The tints and shades on Plates IV. and VI. illustrate the results obtained by this scheme of blending. In combining wools, however, or other materials, though the same proportionate quantities of tinting and toning elements were used as in forming these examples, still compounds of a somewhat different character would ensue, arising from the colour factors being of a fibrous character.

60. *Blends of Wools and Pigments Compared.*—It is important that the dissimilarity between wool and pigment mixtures should be thoroughly understood; for it will be quite evident from the nature of these substances that, though in each the same quantities of similar colours were blended, yet the resulting compositions would be characterized by many features of difference. To these reference will next be made. When two or more shades of wools are amalgamated, each colour—however well the materials are grouped and intermingled in scribbling, carding, and spinning—retains its individuality of hue, which, of course, is opposed to the law of pigment combinations, in which all traces of the original colours, as separate hues, disappear by admixture. Still, when fibrous materials are associated, a sort of new shade, streaked more or less with its composing elements, is obtained. For example, a species of bluish-fawn mixture would result from blending wools as follows:—

9 parts of dark brown.	6 parts of fawn.
4 „ „ pale blue.	4 „ „ green.

But while the resultant composition in this example might be designated a kind of fawn, yet, if it should be closely examined, the brown, pale blue, and green would be discovered, which give bloom and saturation of tone to the whole shade. Providing the same elements were mixed in pigments, they would

yield quite a different result. In only one particular would it correspond to its wool contemporary—it would be a fawn shade; more murky and dingy, however, and scarcely recognizable as being composed of exactly the same colours in like proportions. When paints are mixed, all colours, as individual hues, are totally obliterated, hence a shade is formed in this instance in which the green and blue can hardly be distinguished, the brown and fawn with which they are associated largely neutralizing their effect.

Of course their presence is perceivable, but not to the same degree as in wool mixtures, for the simple reason that, whereas in this latter instance, the fibres of blue and green are mixed and grouped with those of brown and fawn, and the four colours in association form a brownish-fawn mixture, tinted with each of its colour elements, in the case of pigments the particles of various colourings entirely disappear, and combine to constitute a perfectly new shade of somewhat indescribable qualities. It follows that, in one sense, fibrous blends of colours are more effective than those of pigments, for they not only possess the nature of new shades, but the several hues of which they are composed are kept unchanged, enhancing the beauty and intensity of the whole combination. Each colour of filament remains, and is traceable in the mixture as a separate hue, and thus a pleasing and attractive compound is obtained; one, moreover, only producible by blending different colours of fibrous materials. These effects are alone seen in woven textures, and in that class of fabrics in which the colours have been blended prior to weaving or in the carding operations. Should twist yarns be employed instead of various hues of fibres, a more patchy colouring results (see Pattern 2, Plate VII.); one, indeed, in which the colour factors are more prominently separated, and hence devoid of those qualities of neatness and softness invariably associated with mixtures produced in the processes of scribbling, carding, and spinning. Passing to mixtures got in the loom by self-coloured yarns, a still further divergence from a one-shade mixture, resulting from blending several colours, is obtained; for here the several tints employed remain quite detached and distinct.\* Undoubtedly,

in woven fabrics, the most elegant style of mixture is that secured by combining the colours in the material form, or in mixing them in the production of the thread; which method produces a promiscuous shade, tinted, freshened, and brightened with every element of colour entering into its composition; and which constitutes, moreover, quite an evenly-balanced colouring.

61. *Modes of Testing Compositions of Colours.*—Two methods of testing the effect of combining different shades may be practised. First, the most handy system consists in mixing various colours of pigments. Although it is barely possible to represent in this manner the precise result any compound of shades would have in textile materials when scribbled, carded, and spun into yarn, still a fairly accurate idea of the tone and general aspect of a mixture of tints may thus be arrived at. Tests of this kind also serve another purpose—they foster a taste for colouring, and develop the faculty of judging the depth and brilliance of the tone and tint of mixtures in general. This method of testing new sets of colours for mixtures is important. The pigments should be used in solution, which, for convenience, may be kept in small bottles, so that, in mixing, the minutest quantities can be readily and accurately measured off. When thus working with liquid colours, in order to properly test any group of shades, a surface should first be prepared of the principal colour in the mixture. Should this be black, brown, or any other dark colour, it will be necessary to mix the bright colours with white. After the body of the mixture—that is, in this instance, the black or dark brown—has been obtained, the whole should be completed by stippling on to it the other colours in succession, care being exercised not to apply a new colour before that previously used has become perfectly dry. Let an illustration be considered. A mixture of colours which it is required to put through this test is compounded thus:—

4 parts of black.	2 parts of medium green.
3 „ „ scarlet.	1 part of white.

The first process would be to prepare the black surface, employing for the purpose four parts from the bottle con-

taining this pigment in the liquid form. After this has been done, the scarlet, which requires to be first mixed with white, would be stippled over the black, leaving intervals or small patches of the black ground uncoloured. The scarlet dried, two parts of green would be similarly added, and lastly one part of white. In each addition of colour minute spaces should be left of black, and when the last tint has been applied, there should be distinct streaks of the several colours, the black, of course, largely preponderating. If this routine is carefully observed, almost any variety and proportions of colours may be represented. Necessarily there is an absence in the blend thus acquired of that mingled colouring so characteristic of wool mixtures, but still the result is sufficiently accurate to enable the colourist to form a just conception of the value of any shade composition.

Now for the second method of experimenting with colour elements in the origination of new mixtures. Here, wools are used; small hand cards being constructed for the purpose. This is obviously the best system when the exact shades of wools can be acquired, but this is often both difficult and expensive. Where the spinning of mixture yarns is a speciality, it is, however, advantageous to have a small stock of wools in as many shades as possible, which the colourist can have access to and blend in any proportion his ingenuity may suggest.<sup>1</sup> In adopting this practical system of experimenting, the several colours selected for combination ought first to be compared on a convenient surface, preferably black, and then the quantities of the separate tints determined upon. This accomplished, mixing would follow, which consists of placing the various samples on the wire of two hand cards, and then passing the teeth of one card between those of its companion till the filaments have become as perfectly mingled as if the work of mixing had been effected by the scribbling and carding operation. Assuming, for the purpose of illustration, the colours selected to be brown, blue, fawn, and sage-green, and the proportions as follows: 3 parts of brown to 1

<sup>1</sup> In the Standardization Colour Scheme these initial colours, as the principal in the blend, are stocked. Bright or fancy colours might be dyed, in addition, for toning purposes.

part of each of the remaining shades, then, providing the quantities have been weighed off, the several shades would be combined and mixed by the process just described. Care must be exercised not to overload the cards, or blending will only be imperfectly accomplished. Concluding that "carding" has been satisfactorily effected, a compound shade of a slatish or smokish class will be the result, which will contain visible traces of all the colour elements of its composition, namely, of brown, blue, fawn, and sage-green.

Both the "pigment" and the "fibrous" systems of experimenting with colour for blending purposes should be extensively practised. The former may be adopted with success when wools are not accessible, while the latter gives a result identical in every respect to that acquired in manufacturing operations.

62. *Mixtures composed of Two Shades.*—These are of three kinds; first, those in which white is a factor; second, those in which black is used; and third, those in which two fancy colours, other than black or white, are combined, as brown and lavender, purple and gold, and tan and drab. Mixtures of this kind may not only be economically produced, but are simple and neat in composition. Many of them are largely used in the production of both woollen and worsted yarns, and are produced in light, medium, and dark shades. In textures where a neat effect is requisite, they make most satisfactory combinations. Still, they lack diversity of tint; and, as compared with blends containing a larger assortment of colours, they are characterized by tameness. Of course their degree of freshness and lustre is proportionate to the brightness of the hues amalgamated. If these are washy and murky, the resulting combination will be unsatisfactory. While it is impossible to enumerate all the colours suitable for this species of blending, yet it may be remarked that one of the hues should, at any rate, possess bloom and force of tone; not necessarily harshness of hue, but fulness of tint and definite emphasis of shade, in order that it may be capable of affording colour character to the mixture in which it is used. Such colours as claret, maroon, deep purple, russet, chocolate, tan, warm olive, full-toned drab, blue, and green-drab, are appropriate for this purpose.



*63. Compounds of Two Colours in which White is used.—*

Blends of this class are both numerous and important. They are of many tones, depths, and intensities. Three illustrations are given on Plate XIII., comprising light and medium compositions. The first specimen (No. 1) results from mixing 3 parts of white with 1 of brown; the second (No. 2) is composed of 3 parts of fawn and 2 of white; and the third (No. 3) consists of 3 parts of reddish purple and 1 of white. In the first and last of these mixtures the proportions are the same, but in the former, white is the prevailing, and brown the subordinate tint, while in the latter, lavender is the main element, and white simply the secondary factor of the blend. This leads to the consideration that in forming such mixtures it is imperative to determine, in the first place, whether white or the colour element, whatever that may be, is to preponderate in the mixture about to be produced. Having decided upon this point, some calculation should be made as to the extent in which one element is to be overpowered by the other. The illustrations will assist us in the solution of this problem. Starting with the brown and white combination, it is quite apparent that, in this instance, it has been sought to acquire an effect of a light character, one, in a word, just tinged or toned with a brownish element. As a consequence, white should preponderate, but the point arises to what degree. If the proportions were four parts of brown to one part of white, the mixture would be too pale; if three parts of white and two parts of brown were combined, the mixture would assume a dark cast, for the brown element would be too potent; hence the proportions from which the illustration has been obtained are the most appropriate for producing a light-shaded compound. Results of this kind can only be arrived at by experiment. Theory merely expounds the principles of the art, practice alone can illustrate and verify them. With pigments, the reader may acquire much useful and reliable knowledge of these combinations; or by dyeing for himself in a small vessel a number of different shades, which is no difficult task, and using the hand cards alluded to in a previous paragraph, he may become a competent and skilful combiner of fancy shades for mixture yarns.

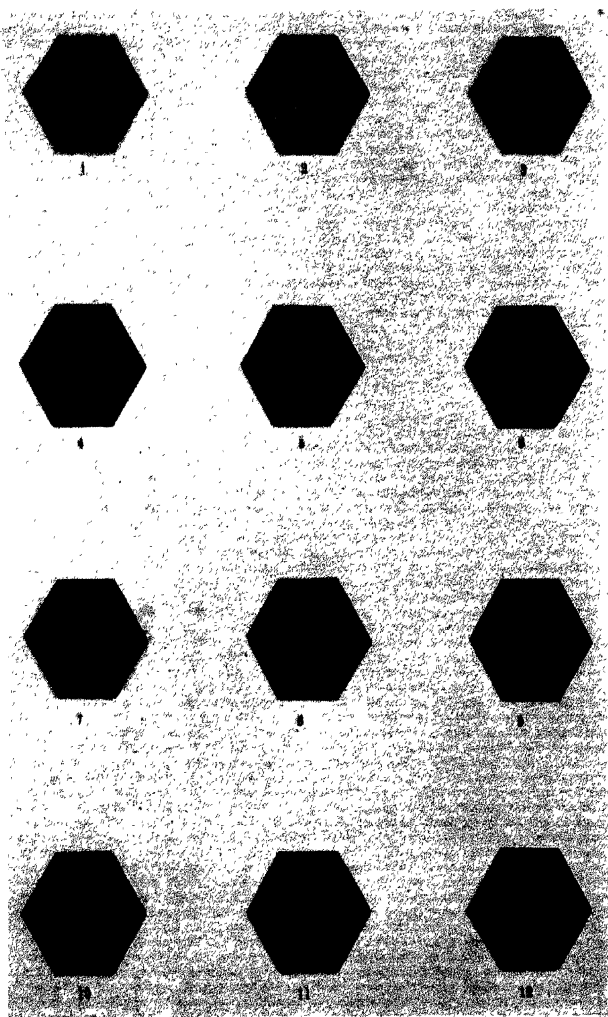


Plate XIII  
BLENDS OF COLOURED WOOLS



64. *Illustrations in Mixtures composed of White and a Second Colour.*—Mixture 3, Plate XIII., is compounded of reddish purple and white. It is suitable for either worsted or woollen yarns intended for dress goods made in the plain weave or in the simple twill. It also forms a yarn capable of giving good results when blended with Mixture 1 of the same Plate. Stripes and check patterns formed of these two mixtures, make very neat and attractive styles. The pinky aspect of Mixture 3 causes it to be applicable to textures for ladies' costumes, in which brightness and warmth of colouring are often a valuable acquisition to the fabric. The white beautifully softens the red purple, the two shades in union, and in the proportions rendered, forming a satisfactory mixture.

The remaining sample in these mixtures (No. 2, Plate XIII.) is the most suitable for tweeds, yet considered. As a compound shade, it possesses many excellent features for both summer and autumn styles. Here, as already stated, white is the minor element of the composition. While in the two preceding examples it predominates, here it simply acts as a tinting factor which gives softness and mellowness to the green drab forming the bulk of the mixture. The utility of white for this purpose is thus clearly seen.

Below are furnished some additional examples in this description of mixtures:—

## I.

3 parts of light bluish drab.  
1 part of white.

## II.

3 parts of tan.  
1 part of white.

## III.

3 parts of olive brown.  
1 part of white.

## IV.

3 parts of slatish fawn.  
1 part of white.

## V.

2 parts of deep chocolate  
brown.  
2 parts of white.

## VI.

4 parts of chocolate.  
1 part of white.

## VII.

6 parts of white.  
4 parts of deep slatish blue.

## VIII.

3 parts of white.  
2 „ of fawn.

Nos. I., II., and III. are specially suitable for yarns employed in the manufacture of dress and other thin fabrics of a bright and cheerful tone. No. IV. is an interesting compound after the nature of No. 2, Plate XIII., but deeper and stronger in cast. Such mixtures are most useful in the production of fancy tweeds and woollen and worsted textures intended for men's wear. Blends V. and VI. are also appropriate for tweed goods. They are both of a brownish character, but the latter is the darker and more pronounced in tone. No. VII. might be defined as a slatish blue mixture. It makes a good fancy yarn, and, in fine worsted, a thread suitable for thin fabrics for costumes. The last of these combinations possesses a very mellow appearance. The fawn is a shade between olive and brown, approaching a species of tan. By altering the proportions to three parts of fawn and one part of white, an excellent mixture results, which might be used in combination with No. VIII. in the production of checks and stripes and a large diversity of other patterns.

65. *Mixtures composed of Black and another Colour.*—These, if anything, have a more extensive application than the mixtures just alluded to, and are probably more diversified in composition and colouring. They are largely employed in the production of yarns for dark and medium-shaded goods. As the illustrations furnished on Plate XIII. indicate, many useful combinations may be obtained on this method. The first example (No. 4, Plate XIII.) that may be considered, is a russet-brown mixture. Probably, the russet is a degree too warm, but, for some purposes, the blend is all that could be desired. Bloom, mellowness of cast, and rich fulness of tint are its chief characteristics. As a tweed mixture produced by using two colour factors, it is invaluable. It contrasts with the following mixture, No. 5 of the same Plate, which results from blending one part of black with one part of light olive. The olive used is more drab than orange, and in association with the black assumes a greenish cast. By combining yarns made of this mixture with yarns made of the preceding mixture, some good patterns might be produced, simple, but neat in composition; the streaks of russet in the one harmonizing and contrasting with the filaments of

olive in the other. The qualities of bloom and warmth lacked by this latter example are possessed by the russet blend, while the mellow characteristic of the olive mixture, when associated with the russet, yields a compound colouring of tasteful properties.

But one further illustration, No. 6, Plate XIII., in this species of blend calls for description, namely, a black and fawn combination in which fawn is the principal hue. It is illustrative of the diversity of effect that may be acquired by mixing two colour elements. As the fawn composes the bulk of the blend, it possesses, when viewed at some distance, a brownish tone, but on closer examination the small flakes of fawn colouring assume a rich bloom as well as a soft, mellow aspect.

Other examples in this style of mixture, not illustrated, may be briefly described, the colourings of which are :—

I.		II.	
5 parts of black.		1 part of black.	
2 „ tan.		1 „ tan.	
III.		IV.	
• 6 parts of black.		4 parts of black.	
3 „ bluish green.		5 „ dark purple.	
V.		VI.	
3 parts of black.		4 parts of black.	
2 „ sage green.		3 „ drabbish fawn.	
VII.		VIII.	
4 parts of black.		6 parts of black.	
1 part of lilac (medium shade).		1 part of rose pink.	

Combinations I. and II. are quite dark. The former is a warmish, and the latter a somewhat cool colouring. Yarns from these two mixtures harmonize well when associated in the same pattern. The tan used in No. I. is similar to No. 3, Plate IV., and the bluish green to No. 2, Plate VI., but rather more blue in tone. Mixture II. is a medium colouring, suitable for suitings and the general run of fancy tweeds. Warmth, freshness, and lustre are its main and characterizing elements. No. IV. is a

## COLOUR IN WOVEN DESIGN.

unique colouring. It forms an admirable dark thread. A fabric in which the warp is composed of yarns made of this mixture and woven with yarn from Blend I. is an excellent combination of tints. Mixtures V. and VI. are both of a medium tone. No. V. is rather dull in tone as compared with No. VI., but both are useful colourings. Blends VII. and VIII. are of a different character. In these examples the colour element is small, but comparatively light and lustrous in tint. The object has been to obtain a black composition just streaked with filaments of a bright shade. The quantity of lilac in No. VII. is just sufficient to change the tone of the black, and to produce a compound approaching a species of grey, but bright and fresh in colouring. No. VIII., though very dark, is cheerful in quality, being suitable for a fancy yarn, or for thin textures for robes and costumes. It is unnecessary to multiply examples of mixtures in this class, as those furnished are typical of the endless variety of combinations which in practice are required by this scheme of colouring.

66. *Grey Mixtures.*—Amongst the most useful mixtures resulting from combining two shades are those known as greys. These are sometimes bloomed or enriched with purple or full-toned blue, but they are more frequently constituted of black and white simply. Ranges of fancy woollen and worsted patterns are rarely made without their use. For ground shades, and also for fancy colours in check and stripe patterns, they are of great utility. Some of the most important and common proportions are as follows<sup>1</sup>:—

I.	II.
6 parts of black.	5 parts of black.
1 part of white.	1 part of white.
III.	IV.
4 parts of black.	3 parts of black.
1 part of white.	1 part of white.
V.	VI.
2 parts of black.	1 part of black.
1 part of white.	1 white.

<sup>1</sup> See also Par. 52 and Plate XII.

## VII.

2 parts of white.  
1 part of black.

## VIII.

3 parts of white.  
1 part of black.

## IX.

4 parts of white.  
1 part of black.

## X.

5 parts of white.  
1 part of black.

## XI.

6 parts of white.  
1 part of black.

The most useful of these combinations are Nos. V., VI., and VII., which are in many instances the only ones used. No. V. is called dark, No. VI. medium, and No. VII. light grey.

To produce a perfectly gradated shade it is necessary to use some five or seven greys, but in ordinary styles, for both woollen and worsted textures, it is not customary to employ a larger number than the three mixtures just named. The following is an arrangement for a shaded pattern in five greys:—

5 or any appropriate number of threads of No. IV.				
5	"	"	"	V.
5	"	"	"	VI.
5	"	"	"	VII.
5	"	"	"	VIII.
5	"	"	"	VII.
5	"	"	"	VI.
5	"	"	"	V.

Mixtures I., II., and III., form very dark shades; and Mixtures XI., X., and IX., form very light shades; and are only employed in the production of extreme fancies.

87. *Bloomed Greys*.—These, as already explained, are greys tinted with some bright hue. The colours generally used for this purpose are very deep purple, rich blue, and red purple. The quantities of such hues are small, but sufficient to impart freshness of tone or lustre to the mixture. Blue is used chiefly in brightening light greys. For example, a much fresher light grey is formed by the following proportions than if black and white were alone used: 6 parts of white, 4 parts



of black, and 1 part of blue. Though the blue only constitutes one-eleventh of the mixture, still it imparts freshness. An excellent medium grey, warmed with reddish purple, can be secured thus: 8 parts of black, 4 parts of white, and 3 parts of red purple. Deep purple is one of the most suitable hues for dark greys, as it possesses both the qualities of warmth and lustre, and is a most potent hue. Two examples follow in which it is used with satisfactory results:—

## I.

6 parts of black.  
2 „ deep purple.  
1 part of white.

## II.

3 parts of black.  
3 „ white.  
2 „ deep purple.

Both these mixtures possess richness and depth of tone, and are preferable to the common greys inasmuch as they are fuller, more lustrous, and mellower in composition; No. I. is a dark, and No. II. a medium shade.

68. *Coloured Greys*.—Mixtures of this kind are mainly compounded of black and white, but the colouring element introduced may be so potent in hue as to impart quite a tinted aspect to the shade. It will be sufficient for the purposes of illustration, to treat of mixtures of this class in which red, blue, yellow, orange, green, and purple, or the primary and secondary hues, are used as the tinting factors. It is very rarely that more than one colour is employed in the same blend, as the examples given will show. Four standard coloured greys, in which red is the tinting element, are as follows:—

## I.

1 part of black.  
1 „ white.  
1 „ red.

## II.

2 parts of black.  
1 part of white.  
1 „ red.

## III.

2 parts of white.  
1 part of black.  
1 „ red.

## IV.

2 parts of red.  
1 part of black.  
1 „ white.

These proportions, giving typical results, will be adopted throughout the exposition of these mixtures; that is to say, when

the tinting element is changed to blue or orange, the same quantities will be combined as in those furnished in the above examples.

In No. 1 the shades are blended in equal proportions, hence there is no tint preponderating in the resultant mixture, which is a species of brownish grey, neat in composition, and one that is useful in textile designing. Black predominates in Mixture II., resulting in the production of a more appropriate shade than that formed by No. I. for autumn and winter cloths. Referring to No. III.—white is the chief element, hence a medium compound shade is acquired: somewhat pinky in appearance, owing to the entrance of white and scarlet into the blend, but still the whole is toned and increased in depth of composition by the admixture of black. It is, on account of its richness, more suitable for yarns for dress fabrics than for heavy goods for men's wear. The same remark applies to Mixture No. IV., in which red is the preponderating hue. But this is a bright and cheerful colouring, and one that makes an excellent fancy yarn. These reddish-grey mixtures all form valuable shades for winter styles, as they are decidedly cheerful and warm in aspect, and produce a kind of pattern both bright and comfortable in character.

Grey, in conjunction with yellow, forms a species of drab mixture, which finds appropriate use in the manufacture of summer textures. Taking the same order of mixing as furnished in the red greys, the following results are obtained:—

## V.

1 part of black.  
1 „ white.  
1 „ yellow.

## VI.

2 parts of black.  
1 part of white.  
1 „ yellow.

## VII.

2 parts of white.  
1 part of black.  
1 „ yellow.

## VIII.

2 parts of yellow.  
1 part of black.  
1 „ white.

The equal quantities constitute quite a drab blend. In this example there is first the association of the black and white.

elements constituting mid grey, which receives additional lustre from co-mixture with yellow, which tinges the whole composition a drabish olive. An agreeable variation may be made by employing a bright tan in the place of yellow. On allowing the black element to preponderate, as in No. VI. blend, a much darker result is attained, one, however, in which the olive cast is preserved, though the bulk of the composition is dark grey. A pleasing mixture ensues when white (No. VII. blend) is made the maximum element. It is soft and bright in colouring, and of extensive utility in the production of fancy yarns and fine worsted textures. Perhaps when yellow is the main shade (No. VIII. blend) the cast of the mixture assumes a too ochre-like aspect, but the yarn resulting from this composition has nevertheless its specific province in woven design.

Black and white mixed with blue form a valuable series of mixtures, more or less applicable to all classes of fancy goods. When the quantities of the several shades are equal (1 part black, 1 white, 1 blue), the mixture formed is of a peacock blue tone, streaked with grey. This mixture may be applied both as a fancy and as a ground shade, according to the texture being produced. Increasing the black (2 parts of black, 1 white, and 1 blue) results in the formation of a dark bluish grey, applicable to a large variety of fabrics. By giving preponderance to the white (2 parts of white, 1 black, and 1 blue), a slatish blue grey is obtained, which, in combination with certain brown mixtures, is capable of forming elegantly coloured patterns. When the blue element is the principal hue (2 parts of blue, 1 black, and 1 white), the mid grey, constituting one-half of the compound, assumes a mellow, quiet blue tone, making a mixture specially appropriate for goods, in which cheerful but soft colouring is an important feature of the design.

It is evident, from these examples, that a wide field of colouring is opened up in the admixture of black and white with the primary colours. In the illustrations considered, only four sets of proportions have been dealt with, but by multiplying these it will be obvious that an endless diversity of results, even with these five shades—black, white, red, yellow, and blue—can feasibly be acquired. But when it is taken into account that

other hues besides those named are used in combination with black and white, it will at once be seen that the possibilities of this preliminary method of combining colours for textile work are largely increased. The subject cannot be followed further than the secondary colours at this stage: these, in conjunction with the primary combinations just described, will give a fairly comprehensive view of the styles of compound shades obtained in practice by this system.

In the first place, allusion may be made to the admixture of orange with black and white. Should the quantities be equal (1 part black, 1 white, and 1 orange), a drabbish grey is produced, a degree warmer in hue than if yellow were the colouring factor. On doubling the quantity of the black element (2 parts black, 1 white, and 1 orange) a greyish olive mixture tinged with a reddish tone is formed; while a light fawn mixture is produced if the white preponderates (2 white, 1 black, and 1 orange). A tannish grey composition, suitable for fancy yarns, results from the proportionate quantities being 2 parts of orange, 1 part of black, and 1 part of white.

Green, when associated with black and white on this system, does not constitute mixtures well adapted for yarns for fabrics of a heavy description, but yields compounds useful in the decoration of dress and other thin textures. These blends partake of a species of mellow, mingled, greenish grey. Such blends are more pleasing to the eye in woven fabrics than solid green, possessing a softer, quieter, and a more satisfactory tone. Beginning with white, black, and green, equally compounded, a mixture is obtained that may be appropriately described as a slatish green, the grey element imparting to the blend a rich mellow cast. By increasing the black factor (2 black, 1 white, and 1 green), the slatish tone is augmented, because it is due to the association of this shade with the green element of the blend. As black is, in this instance, the principal shade, the mixture, while mellow and greenish, is decidedly deep and full in tone. The employment of white as the leading shade (2 parts of white, 1 black, and 1 green) yields an interesting combination between a pea and a slate green. If the yarn made from this mixture, were associated in the same pattern, with

that resulting from blend No. III. of the red series, an exquisite assortment of tints would be obtained. It is by blending the yarn product of one combination with that of others that attractive colourings are arrived at. When the proportions are 2 parts of green, 1 part of black, and 1 part of white, the compound has too greenish a cast to be of extensive use in textile designing, hence this mixture is chiefly used in the form of a fancy or lively thread.

Allusion has now only to be made to the purple-grey combinations. First, when the proportions are 1 part of black, 1 part of white, and 1 part of purple, a distinctly purple grey is produced, owing to the extraordinary potency and diffusiveness of this secondary. Making black the predominant factor, a more useful compound from a textile standpoint is acquired; perhaps slatish in cast, but, nevertheless, warm and cheerful in tint. Should white preponderate, a pure slatish grey, just tinged with the warm, lustrous hue of purple, ensues. These two last combinations, in addition to the mixture resulting from compounding 2 parts of purple, 1 part of black, and 1 part of white, are chiefly useful in the form of fancy threads. If purple is employed in grey mixtures, for tweeds, and other medium and heavy textures, it must be in lesser proportions than here given, indeed on the principle indicated in the examples supplied in Paragraph 66.

Many other colours besides the primaries and the secondaries are blended with black and white in the production of mixture yarns, but the illustrations that have been treated of, will enable the reader to arrive at methods of combining other tints or shades, than those supplied in these mixtures—the most useful of all compound shades—namely, light, medium, and dark greys.

69. *Two-Colour Mixtures.*—Next to the series of blends obtained by combining black or white with another colour, mixtures resulting from associating two colour elements are the most commonly produced. In addition to being the least costly of all fancy mixtures, into which black and white are not imported, they are neat, simple, and elegant in composition. Examples are given in Nos. 7, 8, and 9, Plate XIII. The first is compounded

or 3 parts of bright brown and 2 parts of lavender; the second of 4 parts of claret and 1 part of gold; and the third of 3 parts of tan and 1 part of drab. In mixtures of this class, one shade should always be chosen for constituting the bulk of the compound; and this, of course, should be of such a character as to be suitable for application to fabrics intended for wearing purposes. Turning to these examples, it will be seen that shades of this kind have been adopted as the principal factors, for in one instance, dark brown is the body colour, in another claret, and in the third instance, tan. So that this law of using a comparatively mellow and unostentatious colour for the bulk of the combination has, in this type of mixtures, almost universal application. Alluding specially to the brown-and-lavender blend, the object here has been to secure an intermingled shade of rather more than medium depth. Both colours are prominent, yet they constitute quite a new shade of recognized utility in textile manufacturing. In the claret-and-gold mixture, claret largely predominates, and imparts depth and body of tone to the resulting compound. The function of the gold-coloured fibres is essentially to brighten and freshen the whole. The last example is quite a distinct species, having no common elements with the two preceding, beyond the fact that it only contains two factors of colouring, tan and drab. As these shades are more or less allied in hue, the mixture acquired by combining them is slightly wanting in diversity of tinting; yet it is a style of blend admirably adapted for producing fancy yarns for light goods in woollen materials. Two shades of brown, blue and slate, and olive and drab, similarly blended, would all form creditable mixtures. Some of the Bannockburn blends only contain two colours, though apparently full of variety of tinting. The peculiar nature of the wool fibre substantially contributes to the richness and elegance of these two-colour compounds.

70. *Multi-Shade Mixtures*.—The general principles of the art of blending have now been explained, and it is not needful to treat extensively of the remaining kinds of mixtures. By the aid of further illustrations, the methods of combining any reasonable number of colours in the constitution of "stock" for fancy yarns, may be indicated. First, consider the claret-brown

blend given in No. 10, Plate XIII., and composed of 4 parts of claret, 1 part of drab, and 1 part of gold. The colours combined not only harmonize when mixed, but also when separated. If any one of the colours were removed, the combination would be incomplete, showing the perfect union of the tints selected. Should four colours be blended, increased freshness and lustre of combination may be acquired, as is instanced by No. 11, which consists of 4 parts of black, 2 parts of drab, 1 part of scarlet, and 1 part of white. As in the previous example, a dark shade is here employed for the bulk of the mixture, the other tints combining to impart brightness to the whole colouring. The touch of scarlet is very appropriate, giving warmth and tone; the drab is useful as a filling-in factor, while the black and the white give that general mellowness which characterizes the whole blend. Another example, No. 12, of a dark description is a compound of three colours, blended thus:—

2 parts of purple.

1 part of orange.

$\frac{1}{2}$  a part of warm slate or smoke colour.

The orange should be verging on scarlet, and the purple possess a claret-like hue. A pleasing mixture is thus acquired, one in which the distinguishing features are mellowness and beauty of tone, combined with warmth and richness of composition. Purple and smoke colour are utilized in furnishing that peculiar varied tinting that constitutes the main element of the mixture, while the orange introduced affords brilliance, bloom, and warmth of hue. Other combinations are as follows:—

#### DARK BLENDS.

##### I.

4 parts of brown.

2 „ light brown.

1 part of lavender.

##### II.

4 parts of brown.

1 part of sage.

1 „ scarlet.

##### III.

6 parts of maroon.

1 part of medium green.

1 „ scarlet.

1 „ bright blue.

## MEDIUM BLENDS.

## I.

4 parts of brown.  
 2 „ light olive.  
 2 „ white.

## II.

4 parts of claret.  
 3 „ white.  
 1 part of gold colour.

## III.

8 parts of black.  
 2 „ white.  
 3 „ orange.

## LIGHT BLENDS.

## I.

4 parts mid brown.  
 1 part of drab.  
 1 „ white.

## II.

2 parts of brown.  
 2 „ white.  
 1 part of fawn.

## III.

4 parts of chocolate.  
 5 „ white.  
 2 „ orange.

71. *Twist-Yarn Mixtures*.—Recurring to the three great classes of mixtures defined at the beginning of this chapter, twist-yarn mixtures were included in the second group. For many reasons they are not so extensively produced as raw-material mixtures: thus, they are more costly; they do not generally yield such elegant effects; and they lack that brilliance of colouring so universally characteristic of the latter description of mixtures. The twist used for this purpose includes two-, three-, and four-ply yarns, and curl, knop, cloud, and other fancy threads. Black and white twist mixtures in woollen, worsted, and cotton goods are extremely common. A more marked, and perhaps more streaky class of effects, is obtained by using these yarns than by employing mixture threads. If the twists were of the cloud kind, real spangles, more or less elongated, of black and white shades would be formed in the woven fabric; whereas if curl twists were adopted, loops of black and white would be irregularly spread over the surface of the cloth. Generally, the most elementary weaves are used in the construction of these



goods, such as the plain make, and the common four-end and six-end twills. In worsteds, large quantities of these mixtures are made, the finest of these threads yielding a satisfactory species of intermingled colouring.

72. *Marls*.—A series of grey and coloured mixtures obtained by the second method of blending (Class C, Par. 55) is illustrated in Plate XIV. These yarns show the principle of obtaining a marl mixture worsted thread, after combing and drawing, or in the operation of roving. An intermediate style of mixture is thus produced between that due to blending coloured slivers in drawing, and that due to folding or twisting two or more coloured yarns into a compound thread. The blending of the coloured elements is not, on this system, so complete as by the first method; nor yet are the specks of colour so distinct as in mixture yarns obtained in twisting. “Marls” made in this way are combined in stripe and check patterns with similar mixture yarns developed by doubling or folding.

The proportionate quantities of black and white in Series A and A', and of black and a colour in Series B, B' are as follows:—

#### PLATE XIV.

##### MARLS, SERIES A AND B.

Specimen I.	= 1 black thread twisted with 1 marl thread = 25% white or colour and 75% black.
“ II.	= “ “ “ “ = 50% “ “ 50% “
“ III.	= “ “ “ “ = 75% “ “ 25% “
“ IV.	= 1 marl = white or colour 25% and black 75%; twisted with 1 marl thread = 25% white or colour and 75% black.
“ V.	= 1 white thread twisted with 1 marl thread = 25% white or colour and 75% black.
“ VI.	= “ “ “ “ = 50% “ “ 50% “

##### MARLS, SERIES A1 AND B1.

Specimen I.	= 1 marl thread = white 25%, black 75%; twisted with 1 marl thread = white 25%, black 75%.
“ II.	= “ “ “ “ = 50% “ “ 50%; “ “ “ “ = “ 25% “ 75%.
“ III.	= “ “ “ “ = 50% “ “ 50%; “ “ “ “ = “ 50% “ 50%.
“ IV.	= “ “ “ “ = 75% “ “ 25%; “ “ “ “ = “ 50% “ 50%.
“ V.	= “ “ “ “ = 75% “ “ 25%; “ “ “ “ = “ 75% “ 25%.
“ VI.	= 1 white thread twisted with 1 marl thread = white 75%, black 25%.

In Nos. I. to V., Series A' and B', each yarn is composed of two marl threads twisted together, but No. VI. consists of a white thread twisted with a marl; and in Series A and B, Nos. I., II., and III. are composed of a marl and black: No. IV. of two marls, and Nos. V. and VI. of a marl and white.

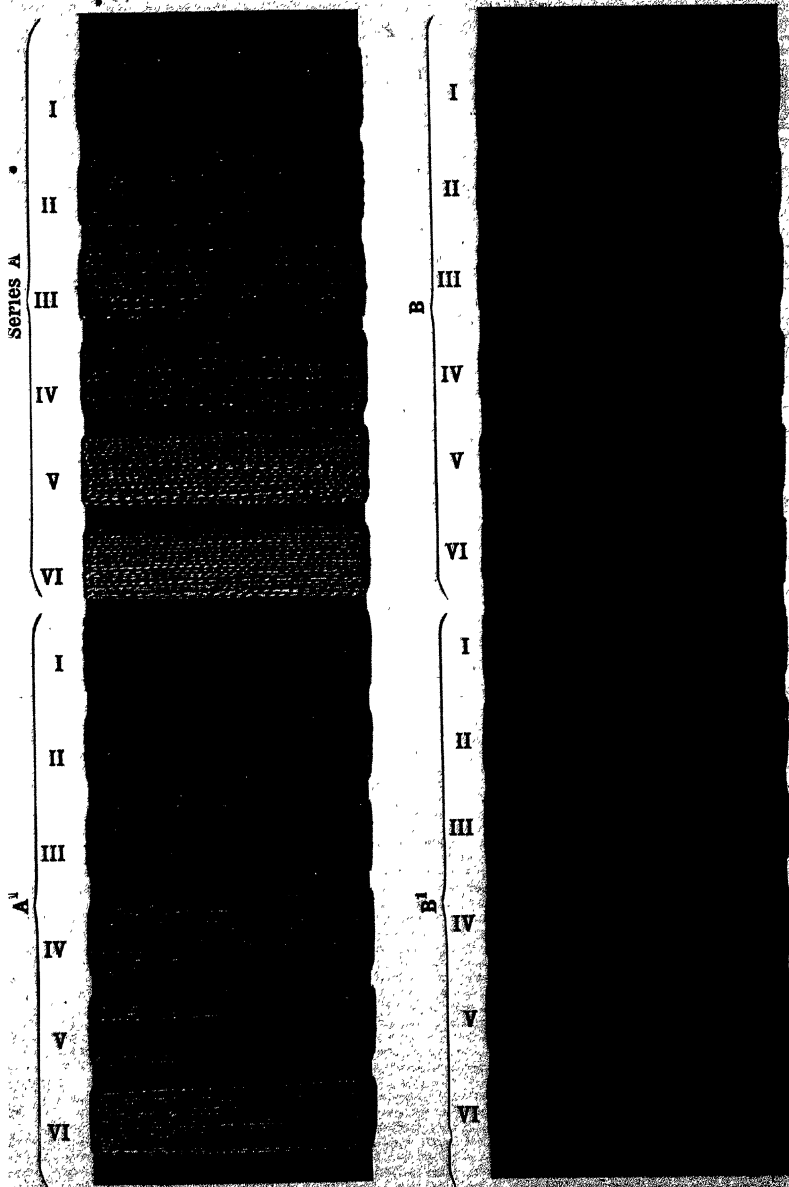


Plate XIV  
SPECIMENS OF "MARL" YARNS



73. *Weave Mixtures*.—These are least manufactured of any of the three classes of mixtures. They result from intermingling self-coloured yarns in the loom. Plain and other elementary weaves are alone suitable for producing these effects. It is usual to have the warp of one colour, such as grey, and the weft of two or more colours; or the warp of two or more colours, and the weft of one. In neither of the two foregoing classes of mixtures could anything approaching a repetition of effect be traced in the woven sample, whose surface is invariably one mass of mottled tinting. For an analysis of the principles on which these patterns are acquired, the reader is referred to *Woollen and Worsted Cloth Manufacture*.

## CHAPTER VI.

### ELEMENTS OF TEXTILE COLOURING—STRIPES.

74. Colours applied to Textiles on Various Systems—75. Types of Woven Colouring—76. Single Weave Colourings—77. Colour in relation to Backed, Double, and Compound Cloths—78. Colour applied to Single-make Figured Fabrics—79. Fancy Shades applied to Backed and Double Weave Combination Designs—80. Colour in Designs in which the Figures are produced by the Weft Yarns—81. Figured Effects obtained by Warp Colouring—82. Colour in Textiles Figured by both Warp and Weft Yarns—83. Pattern Design—84. Styles due to Colouring only—85. Stripes—86. Checks—87. Mixtures—88. Figures—89. Classes of Striped Patterns—90. Hairlines—91. Compound Hairlines—92. Stripes composed of Longitudinal and Transverse Lines—93. Stripes composed of Two Colours—94. Stripes composed of Three or more Colours—95. Irregular Stripes composed of Black and White Yarns—96. Irregular and Indefinite Stripes in Two Colours—97. Irregular Stripes—Shades in Two Colours—98. Shaded Stripes in Two Colours—99. Irregular Stripes containing several Colours—100. Shaded Stripes in several Colours.

74. *Colours applied to Textiles on Various Systems.*—There are numerous methods of introducing colours and fancy shades into woven patterns. According to the kind of fabric being produced, the nature of the materials composing it, and its structural arrangement, the scheme of colouring practised varies. *Suitings*, *trouserings*, *mantlings*, *dressess*, *vestings*, *shawls*, *rugs*, *carpets*, and other important typical textures, are all coloured on distinct principles. *Worsted*s are not treated in a colour sense precisely on the same system as *woollens*, nor *silks* as *cottons*. *Simple weaves* allow of more varied colouring than *diagonals* and other intricate crossings; *figured designs* of a *floral* or *geometrical* character, than those resulting from combining several small weaves; *single-make* than *double-* and *treble-make* patterns; *ordinary decorative fabrics*, than *plushes* and *lenos*, and so on. Yet there are some principles of textile colouring common to all species of woven design. Certain methods of

grouping yarns in elementary plans of interlacing warp and weft yield, under all conditions, the same style of effects. As a well-known combination of lines makes the key pattern, so in textile designing there are methods of classifying and uniting shades which cannot but produce one form of pattern. While in subsequent chapters it will be needful to specialize and indicate the complex modes of colouring practised by the weaver, here the general principles of the art will be simply expounded.

75. *Types of Woven Colourings*.—All varieties of textile colourings may be classified under two great heads, which are capable of subdivision, as in the Table appended.

#### TABLE VII.

##### ILLUSTRATING THE TYPES OF WOVEN COLOURINGS.

###### I. COLOUR IN SIMPLE AND FANCY WEAVES.

(A) *Single-make Cloths*.—Woollen, worsted, cotton, linen, and silk textures, in plain, twilled, mat, sateen, corkscrew, leno, diaper, and other weaves.

(B) *Backed, Double, and Compound Cloths*.—Effects produced principally for men's wear, in both woollen and worsted yarns; also rugs, travelling maudés, winter mantlings, and blankets.

###### II. COLOUR IN FANCY AND FIGURED PATTERNS.

(A) *Single Fabrics*.—Stripes, checks, and drafted patterns for dresses, mantlings, ulsterings, blouses, and other textures.

(B) *Backed, Double, and Combination Patterns*.—Woollen and worsted patterns for men's garments; shawls, mantlings, rugs, "Kidder," Scotch, and other carpets; also damasks and decorative fabrics.

(C) *Figured Patterns Coloured in the Weft*.—Vestings, dresses, matelasses, and cords.

(D) *Figured Patterns Coloured in the Warp*.—Spotted and figured styles of various descriptions in simple and complex makes, fancy dress patterns, mantles, plushes, velvets, astrachans, and carpets.

(E) *Patterns in which the Figure is developed by both Warp and Weft Colouring*.—Silk and worsted robes, and elaborately ornamented patterns in an endless diversity of textures and materials.

76. *Single-Weave Colourings*.—The single-make cloths, named in Group A of the first class of coloured effects, are textures not only single in structure, *i.e.*, not backed, but composed of one weave of a simple character. Here some of the most elementary types of textile colouring occur. Many of the patterns produced in these weaves are due to the arrangement of the shades of the warp and weft. They form a species of woven design which is purely technical in construction. The artistic knowledge requisite to their origination is exercised in the selection and combination of colours. As regards the elements which give the pattern its form or outline, these are solely of a technical nature, and relate to dexterity and ingenuity in the invention of novel plans of cloth construction, and of applying to such makes those schemes of colouring which will most effectively develop their structural composition. This class of textile pattern may be described as Woven Colour Design, for it is one in which the all-important principle consists in devising new systems of shade arrangement and distribution. When considering pattern as obtained in simple weaves, this feature of design is the most prominent for examination. Scotch tweeds, as well as various classes of fancy woollens for suitings, trouserings, and flannels, some styles of cotton fabrics, and a considerable diversity of worsted, silk, and linen fabrics, are examples in this style of pattern. The more or less complex nature of these textiles is determined by the intricacy of the weave employed, and the plan of grouping the shades. Irregular makes or crossings, such as diagonals, fancy twills, diamond and broken weaves, are more difficult to treat with colour than simple twills and hopsacks. The comprehensiveness of this type of textile colouring will be evident when it is mentioned that in the plain weave, and the cassimere twill, there is practically no limit to the variety of patterns obtainable in stripes, checks, diagonals, small figures, mixtures, spotted, and other styles.

77. *Colour in relation to Backed, Double, and Compound Cloths*.—The fabrics named in Section B of Part I. of Table VII. are much more intricate in structure than those alluded to in the previous paragraph, and hence require greater technical skill in colour treatment. As these cloths are multi-ply in the weft.

in the warp, or in both warp and weft, they can only be economically and advantageously coloured when their build or structure is thoroughly understood. The yarns employed in the composition of the face pattern have to be kept distinct from those forming the back of the fabric, and *vice versâ*. Frequently, the colouring of the face forms a different style from that on the back, in which case a combination of at least two principles of colouring takes place.

The range of patterns in these makes is very diversified, but it is confined to a somewhat limited class of goods, as indicated in the Table. Winter fabrics for men's and women's wear are the principal goods to which these weaves are applied, so that for climatic reasons light and fancy patterns are only exceptionally in demand, a fact which somewhat simplifies the application of colour to these styles. Some heavy tartan travelling rugs and wraps are also constructed in this type of weave. In the ordinary backed textures composed of one make on the face, the patterns are mostly of a simple stripe or check arrangement, but in rugs and heavy cloths elaborate and complex blends of shades obtain.

78. *Colour applied to Single-make Figured Fabrics.*—These form the A Group of textures given in Part II. of the Table. In addition to the effect in this instance due to association of colours, there is design or pattern produced by a combination of weaves differing in structure or build, and moreover in appearance in the woven fabric. The weaves may be arranged to form stripes, checks, and figures. The classes of goods to which these designs are applied are numerous, including trouserings and coatings in woollen and worsted yarns, fancy dress goods, mohair, silk, and other classes of mantlings, ulsterings, silk handkerchiefs, cotton textures, and decorative fabrics. The principles involved in this type of textile designing comprise the application of colour in the development of simple weave effects, and its introduction into designs composed of several weave elements to give precision and smartness of figuring. Before colour can be suitably applied here, its effect on the elementary crossings must be clearly apprehended. The designs containing various makes, such arrangements of fancy shades have to be used as will



emphasize exactly the several parts of the whole style, and not result in the suppression of some sections and in too bold a development of others. The larger the number of weaves entering into any single design, the greater the intricacy of colour application. When colour, in relation to the *A* Group of fabrics in the first section of the Table, is understood theoretically and practically, its functions and scope in this branch of designing may be readily mastered.

79. *Fancy Shades applied to Backed and Double Weave Combination Designs.*—Winter goods of a figured order for apparel are included in Group *B* of the Figured Patterns. This class of textiles also comprises some styles of shawls, mantlings, and rugs. Many types of striped trouserings, in which two double makes occur, come within the scope of this useful group of textiles. Generally, if the method of colouring is simple, the combination of weaves is diversified; but should the latter only comprise a few elements of weaving, more complex schemes of colouring are requisitioned. This order of patterns, moreover, includes certain species of textile effect not producible by having recourse to any other principle of weaving, but those appertaining to double-cloth combinations. Regarding the style of figuring feasible, it may be either elementary or elaborate in arrangement. Every description of ornamentation can be developed, from the simplest rectangular pattern to the most fantastic and complex blend of floral and other forms. It is this feature of this principle of design and colouring which makes it useful in the production of various kinds of reversible fabrics—textures figured and wearable on both sides, such as shawls, Austrian blankets or rugs, and carpets. Yet while the application of colour to these designs may yield these elaborate loom productions, the same scheme of colouring applied to the identical type of weave designs, may give such patterns as obtain in fancy trouserings, suitings, mantlings, and ulsterings of infinite variety of style. The structure and weave composition of these fabrics, and modes of gaining effects in them by colour, will be explained in detail later.

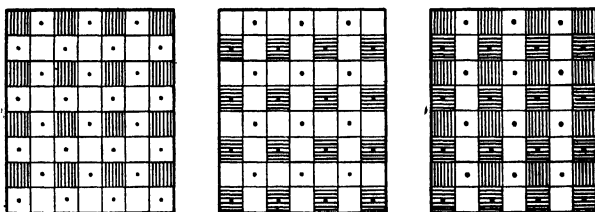
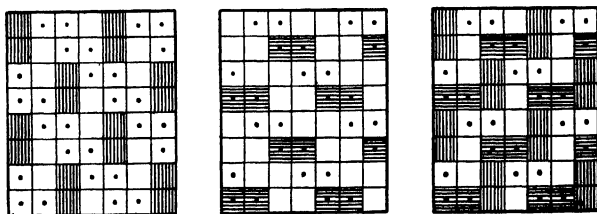
80. *Colour in Designs in which the Figures are produced by the Weft Yarns.*—In Group *C* the Textiles mentioned are vestings,

• dresses, matelasses, and curl fabrics. This is an interesting type of weave design in which colour is of great utility in developing the integral parts of the figures composing the pattern. Warp yarns in these goods are only of secondary importance, the figured elements of the styles being solely the product of the weft yarns. These are, therefore, of various shades, while the warp is generally, although not necessarily, of one colour. Strictly speaking, these fabrics may be several fold in the weft, but they are invariably single in the warp. The extreme fancy character of the textures to which this principle of designing and colouring is applicable, is indicative of its scope. It is specially useful in fancy vesting styles, and is absolutely essential to the construction of one important class of matelasses, and also invaluable in the weaving of some kinds of curl cloths made for mantlings.

81. *Figured Effects obtained by Warp Colouring.*—This is the reverse of the preceding principle of intertexture. All the fabrics enumerated in Class *D* are constructed on this system. They have one weft and several warps, the number of the latter varying according to the multiplicity of colours forming the pattern. Warp colouring is applicable to an extensive variety of fabrics. Commencing with the simplest type first, this system of colouring plays an important part in spotted designs, or patterns in which the distinguishing feature is a series of spots or minute specks of bright colours. These effects appear in suitings, mantlings, dresses, and cotton goods, including fabrics for small-ware purposes. Very elaborate dress styles are also figured by several sets of warp colourings. Here the weft is a sort of binding agent, uniting into one compact and firm fabric the various elements of warp colouring. Velvets and figured plushes, comprising astrachans and pile goods made in imitation of animal skins, in addition to Brussels, Axminster, and velvet-pile carpets, owe their design composition to the employment of two or more layers of warp threads.

82. *Colour in Textiles Figured by both Warp and Weft Yarns.*—This is the most comprehensive of all classes of textiles to which colour is related. The most elaborate patterns made in the loom, and the most costly, are the product of combining both warp

and weft colouring. It is quite evident, on consulting Table VII. of the different types of textile colouring, that, in theory, the *E* Group of fabrics results from combining the systems of weaving included in Groups *C* and *D*, but, in practice, as subsequent analysis will demonstrate, other details of designing and colouring are involved in the execution of this class of fabrics than those here comprised. As this species of colouring finds expression in all the types of figured woven effects specialized in the above mentioned styles of fabrics, it is useless to

FIG. 5.—*A, B, C.*FIG. 5.—*D, E, F.*

attempt further classification. These styles are intricate in build and unique in principles of intertexture. Usually, they are neither purely double, nor yet purely single in construction, but embrace schemes of designing and colouring, such as may only be mastered by those who previously study the former fabrics to which colour is applied, and which are named in Table VII.

83. *Pattern Design*.—This style of pattern results solely from the methods of grouping fancy warp or weft yarns, or both these elements of textile fabrics. It may be appropriately designated "Colour" to distinguish it from "Weave" design;

for, if the colours are removed from such patterns, all effect is destroyed. Colour here yields both the form of the design and the beauty of the style. No type of textile designing is more extensively utilized than this, for the styles resultant are characterized by neatness and by great utility. Pattern design relates not only to the artistic grouping or blending of shades, but to their arrangement. The latter is a factor which has to be suited to the build of the weave. The same plans of colours are capable of yielding quite distinct effects in two different weaves. Fig. 5, *A*, *B*, and *C*, and Fig. 5, *D*, *E*, and *F*, demonstrate this important principle of textile colouring. The weaves (marked  $\square$ 's for weft) are plain in Fig. 5, *A*, *B*, *C*, and  $\frac{2}{2}$  or cassimere twill in Fig. 5, *D*, *E*, *F*. The effects of different marks in the sketches, and also the methods of warping and wefting, or the order of colouring, are stated in the following Table:—

TABLE VIII.

ILLUSTRATING THE EFFECTS ON THE PLAIN AND  $\frac{2}{2}$  TWILL WEAVES OF THE CHANGING OF THE ORDER OF WARPING AND WEFTING.

Section.	Warp.	Weft.	Effect in Sketches.
<i>A and D</i> Fig. 5 {	1 thread grey 1 „ white	White	$\square$ 's = white warp over white weft. $\blacksquare$ 's = grey „ „ „ $\square$ = white weft over grey and white warps.
<i>B and E</i> Fig. 5 {	White	1 pick grey 1 „ white	$\square$ 's = white warp over grey and white wefts. $\blacksquare$ 's = grey weft over white warp. $\square$ 's = white „ „ „
<i>C</i> Fig. 5 {	1 thread grey 1 „ white	1 pick grey 1 „ white	$\square$ 's = white warp over grey weft. $\blacksquare$ 's = grey warp over white weft $\square$ 's = white weft over white warp. $\blacksquare$ 's = grey weft over grey warp.
<i>F</i> Fig. 5 {	1 thread grey 1 „ white	1 pick grey 1 „ white	$\square$ 's = white warp over grey and white wefts. $\blacksquare$ 's = grey „ „ „ $\square$ 's = white weft over grey and white warps. $\blacksquare$ 's = grey „ „ „

The arrangement of the yarns in the examples is the same, but the weave structures are dissimilar. The plain make so

determines the crossing of the warp and weft yarns, that the white picks always float under the grey threads and over the white threads, while the grey picks always float under the white and over the grey threads, hence the solidity of the respective lines of colour is uninterrupted, and a pattern produced of a simple stripe order. Coming to the twill weave, it distributes the colours differently. Each pick floats over and under two threads at a time, so that the picks at every interlacing cover, or are covered, by both a grey and a white thread. Let it now be shown what is the result of this. Supposing the first thread and pick to be grey (Fig. 5, *F*) and the second thread and pick white, then, if the effect of the interweaving of the first pick is traced, it will be obvious how it forms part of the minute diagonal pattern sketched in Fig. 5, *F*. This pick floats over a grey and a white, and then under a grey and a white thread, so that a small transverse line of grey is formed equal in length, not to a float over *two*, but *three* threads, for although the extent of the weft float is two, yet the grey thread adjoining it enlarges it in effect to three. Next take the second pick. It floats over the second and third threads, and, being white, makes a transverse line of this shade of similar dimensions to the preceding pick, because the fourth thread in the warp is white, and in the texture is added to the two-weft float. If picks three and four are examined, it will be noticed that they give like results, only the positions of the small lines of colours are moved one thread in each case to the right, causing the diagonal effect in the fabric to move to the right. Analyzing the first and second threads, it will be seen that they make short vertical lines, equal in length to flushing over three picks in succession. Take the first thread, which is grey: it is depressed on the first pick, being covered by the grey pick, then up twice; the second thread is also down on the first pick, then down on the second pick, being covered by the white weft, and afterwards elevated over picks three and four, forming a float of white of the same size as if the thread had flushed over three succeeding picks.

These illustrations show how the structure of the weave modifies the effect of the colours. This relation of weave to colour, as regards systems of arranging fancy shades, is one of

the technical elements of textile colouring. Weaving principles cannot be ignored; they must always be considered, as they are capable both of destroying or of beautifying a set of colours.

Pattern design also relates to the invention of novel methods of grouping fancy threads, or to the assortment and distribution of the several colours in both warp and weft. Independent of the somewhat subtle question of harmony of tints which has to be considered here, such schemes of blending warp and weft threads of appropriate colours have to be devised as will give various styles in the same order of colourings and the same weave. By a modification of the plan of combining the yarns great variety of pattern may be obtained. Even when limited to this mode of producing pattern in the loom, novelty and force of style is feasible. The simplest alteration in the grouping of the threads frequently gives quite a new cast to the design. There are three features of Pattern Design that are intimately associated with the character of the pattern originated: I. the selection of appropriate shades; II. their classification and arrangement as to quantity; and III. the invention of such a plan of combining these colours in the fabric as will be in accordance with the construction of the weave or design composing the cloth.

84. *Styles due to Colouring only.*—The patterns produced wholly by varying the plan of associating colours in textiles may in a general sense be grouped under four heads, viz., Stripes, Checks, Mixtures, and small Figured Effects. These designs obtain in a large variety in all kinds of materials.

85. *Stripes.*—Treating of each description of style analytically, stripe patterns may be primarily examined. They consist of bands or lines of different shades, varying in width, running lengthways of the fabric, that is, in the direction of the warp. The distinctive characteristic of a stripe is its line-like composition. All patterns of this order are nothing more than a blend of lines of divers shades and of various dimensions, extending from end to end of the piece. For trouserings, suitings, and some styles of dress and mantling cloths, no form of pattern is better adapted. The prominence of the several bands of colour, their solidity and distinctness, or their intermittent character and subdued or toned aspect, are all qualities depending on the structure of the fabric

and its weave composition, which will be subsequently noticed. If the pattern in striped styles is principally a warp product, the weft is only a supplementary feature of the design, being employed, firstly, to bind the warp ends together and thus form a wearable fabric; and, secondly, to constitute an appropriate groundwork on which the warp colourings may be correctly developed. Proper emphasis of the colours composing the stripes is acquired by employing a suitable shade of weft, and by adopting that system of crossing or weaving which will, in addition to yielding the requisite strength and firmness of fabric, sufficiently interfere with the continuity of the fancy shades introduced into the warp. Stripes are of various dimensions and arrangements. Some are mere lines, and no wider than the diameter of the threads employed; others are many inches broad. One colour may be so introduced as to form bands of different widths. Thus, if brown and black were the colours at command, they could be so combined as to give styles of several descriptions in which the bands of the respective shades would always be of corresponding widths; or they might be combined on such a principle as to form sets of stripes of variable sizes. To a considerable extent, the character of these patterns is governed by the class of texture in which they appear. Instances of this occur in the various fabrics produced in the loom. Generally, for example, stripes for trouserings are not wide, but of small and medium sizes, and soft and neatly toned in colouring. For ulsterings, dresses, and mantlings, much broader effects, more elaborate in arrangement, and of greater force of colouring, are required. In cotton blouses, small styles are the most valuable, but in cotton fancies for dresses there are no definite limits to the width of the stripes and to the intricacy of the plan of colouring.

86. *Checks*.—These may be considered as forming the second great class of patterns in which colour is the all-important element. Of course reference is only made at this time to that type of check in which the weave is a simple factor. No allusion is made to, or consideration taken of, weave compounds which of themselves will form a species of check. The checks now being examined are those resulting from adopting the same or a

similar order of weft as warp colouring. In other words, if the arrangement of warp yarns were 10 threads of black and 2 threads of white, the weft would be the same, forming a solid square of black, surrounded by a skeleton square of white. The term "check" is suggestive of the appearance of these styles and of the scheme of their construction. The warp colourings, however complicated in arrangement and diverse in composition, to produce a perfect check must be crossed or "checked," as the operation is technically called, in precisely the same manner and by exactly the same shades in the weft. The plaids on Plates V. and X. are typical examples of the principles of checking. Here it is evident that each set of colours in the warp when woven with corresponding shades of weft forms a square of colour perfectly solid. The blue threads of warp and weft make blue checks; the green, squares of this colour; and the black and yellow also checks of these shades. The size of the check is determined by the mode of grouping the yarns, the coarseness of the texture, and the thickness of the yarns of which it is composed. Many of the principles of woven colouring applicable to stripes also apply to checks, which strictly speaking are patterns striped both in transverse and lineal directions.

87. *Mixtures*.—The mixtures implied here may be defined as small all-over effects in which the various colours used are so fully co-mingled that the particular part played by any one colour is not observable. They require the most mellow treatment of all coloured styles. Nothing of a loud character succeeds, nor appears attractive in these textures. Mellow, smart, and choice combinations are desired. The pattern should present not so much a patchy, as a rich and tinted appearance—every colour utilized in its formation associating with its neighbours to compose one indefinite blend of minute effects. To produce styles of this order no single colour should be distinct and louder than the rest, nor be allowed to intrude on the eye more than another—complete harmony of colouring and uniformity of tone are absolutely essential. But one shade more pronounced in tint or more powerful in hue—being of a deeper intensity than its associates—is sufficient to destroy the beauty of the whole combination. This being the case, the system of mixing the



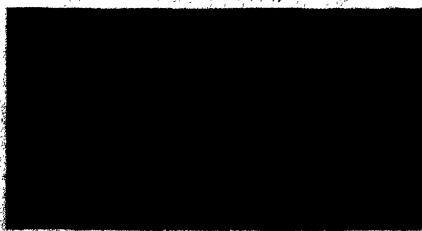
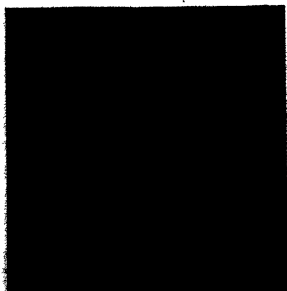
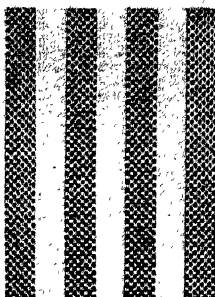
several shades must be such that all colours will be equally emphasized; for evidently lack of equality in the prominence of the various colour elements amalgamated, destroys the essential character of these useful and valuable styles.

Mixtures obtain principally in woollen yarns, whose fibrous surfaces are well adapted for mixing the hues combined thoroughly, and without producing a fabric in which the colours form patches or spangles of variable sizes and shapes. All mixture effects are minute in character, and are produced for suitings, dress fabrics, etc. In softness and mellowness of tinting, these are not comparable with similar styles resulting from using mixture yarns, but they form such an important description of woven pattern as to deserve specific analysis.

In Donegal (Pattern 1, Plate XXVI.) and other extreme fancy mixtures, specks of bright colour are obtained in the yarn, which give richness of character without that complete mixing of fibres which is the ordinary style of blend.

88. *Figures*.—Necessarily these are very minute in dimensions and limited in form. Perhaps they might be also appropriately designated spotted patterns, but as the figures are of definable shapes, and are arranged on various bases, the former term appears the more suitable. This species of colouring is applied to cotton and woollen and worsted fabrics. Invariably the weaves are of an elementary grade. In these, neat and minutely figured styles are developed in considerable variety. Thus in the plain weave alone, several distinct patterns are obtainable; while in the celtic, or mat, and in the cassimere and six-end twills somewhat more broken-up figuring is acquired, which for some makes of cloths is preferable to designs consisting of pronounced and decided forms.

89. *Classes of Striped Patterns*.—All kinds of striped patterns may be comprised in two classes, namely, Regular and Irregular styles. In the former (Fig. 11, *A*, and Fig. 12, *A*) the bands of colours, however numerous they may be, are of equal widths, but in the latter (Figs. 11 and 12, *B*, *C*, *D*, etc.) they vary to an indefinite extent. The several species of stripes resulting from blending colours will be treated of as follows:—



2

Plate XV  
**REGULAR STRIPES**  
 1 and 2. Two-Colour Patterns  
 3. Four-Colour Pattern



## I. REGULAR STRIPES.

- (a) Hairlines.
- (b) Stripes of two colours.
- (c) Stripes of three or more colours.

## II. IRREGULAR STRIPES.

- (d) Patterns of two colours.
- (e) Patterns of three or more colours.
- (f) Shaded patterns composed of several colours.

FIG. 6.

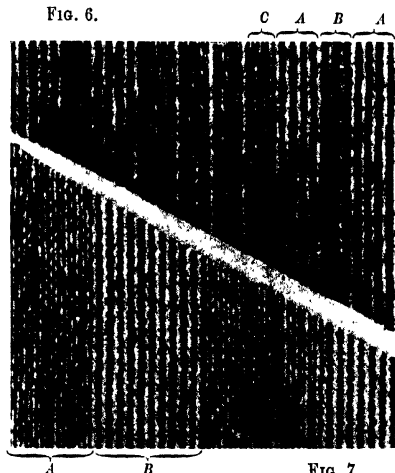


FIG. 7.

90. *Hairlines*.—These are the smallest striped patterns produced. The real hairline is composed of two colours, and is made extensively in woollen and worsted materials, but is also produced in cotton and other yarns. Standard hairlines are produced in the plain weave, prunelle,  $\frac{3}{1}$  twill, and the five-end sateen: also in mat and specially-constructed weaves. In the prunelle, three-line, in the  $\frac{3}{1}$  twill, four-line, and in the five-end sateen, five-line, or five-colour patterns are producible.

91. *Compound Hairlines*.—These consist (1) of two or more widths of lines with each grouped in series, of which Figs. 6 and 7, and Figs. 8 and 9 are types; (2) of hairline stripes combined

with fancy and irregular effects. Figs. 6 and 7 are both woven in the broken  $\frac{3}{1}$  twill, the former being coloured two-and-two in section *A*, 2 black, 2 twist in section *B*, and one-and-one in section *C*, the broad line of white being formed by grouping three white threads together. Fig. 7 is a compound of one-and-one and two-and-two warping, making the respective stripes *A* and *B*, which might be of any width and grouped together in various forms.

Fig. 8 is developed in mat weaves, arranged to produce two-

FIG. 8.

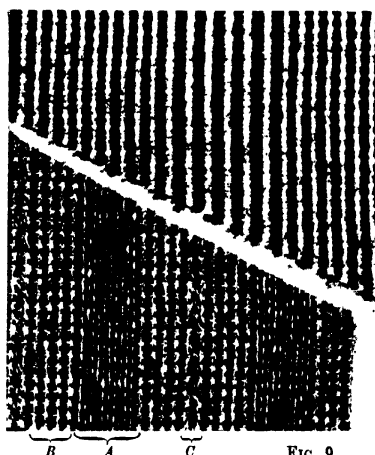


FIG. 9.

and-two and four-and-four stripings, grouped as sketched. Fig. 9 is a compound of hairline effect, one-and-one warping in the broken  $\frac{3}{1}$  twill, section *A*, and of two-and-two warping in the  $\frac{2}{2}$  twill, section *B*, with a fancy twist stripe, *C*, on the latter.

92. *Stripes composed of Longitudinal and Transverse Lines.*—This pattern—sketched in Fig. 10—is a derivative of the common single-cloth hairline. It is due to changing the positions of the colours in relation to the intersections of the weave. Analysis of the fabric shows that in Sections *A* the light threads float over the light picks and the dark threads over the dark picks; whereas in Parts *B* the opposite rule obtains, viz., the light

threads float *under* the light picks and the dark threads *under* the dark picks. As a consequence, the lines of colours in *A* are vertical, while those in *B* are horizontal. This arrangement of pattern is entirely due to the system of warp colouring, which is as follows:—

1 thread of grey.	} <i>A</i> .
1 „ white.	
1 „ white.	} <i>B</i> .
1 „ grey.	

The weft is 1 pick of white and 1 pick of grey throughout the pattern. Now as the plain weave has been employed, and is arranged to allow the white and grey threads in *B* to be crossed

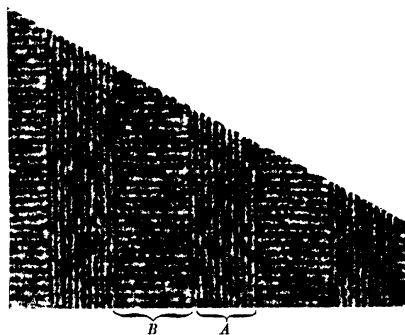


FIG. 10.

or covered by corresponding picks, it causes the same threads in *A* to float over the respective picks, producing this useful form of stripe, which is applicable to similar goods as those for which particulars are supplied in the preceding paragraph.

93. *Stripes composed of Two Colours.*—These are included in the elementary colour effects. A minimum amount of technical skill is requisite to their construction. The art of producing patterns of this description is confined to the selection and adjustment of appropriate shades. An illustration in the Regular order of stripes is given in No. 1, Plate XV. It is an Oxford shirting, the order of colouring being thus:—

<i>Warp.</i>	<i>Weft.</i>
16 threads of white.	All white.
16 „ blue.	

Such shades and tints as the following would form good patterns: No. 6, Plate IV., and white; No. 10, Plate IV., and white; and Nos. 12 and 16, Plate VI., and white. In each case white should be used for weft.

This class of pattern is largely applied to woollen and worsted textures. No. 2 on Plate XV. is an example. • This style has

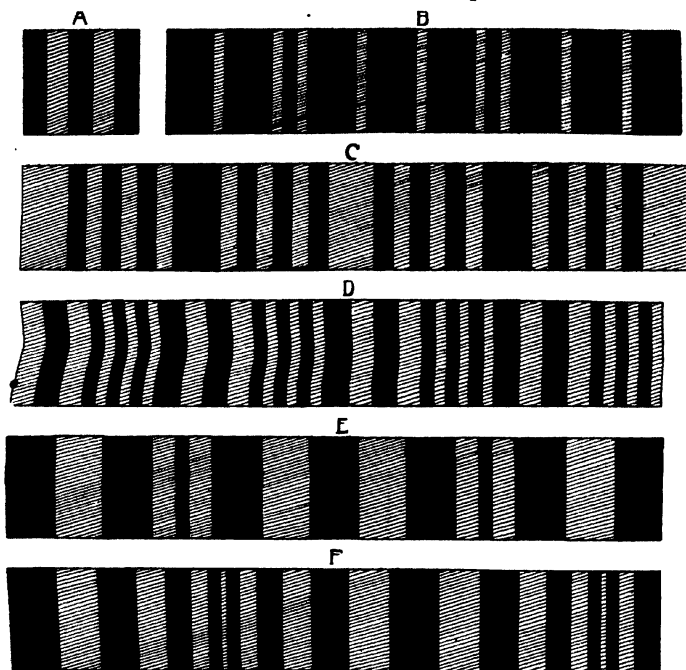


FIG. 11.—Stripe Patterns in Two Shades.

been produced in the five-end doeskin and has a dress-face finish. The arrangement of colours is:—

*Warp.*

10 threads of 20 skeins olive.

10    "       "       "       light olive.

*Weft.*

20 skeins olive.

Without multiplying illustrations, it will be evident how con-

siderable diversity of styles is attainable on this system by varying the width of the stripes and the colours employed.

Specimens of Irregular stripes in two shades are given in Fig. 11, *B, C, D, E, F*, consisting of lines of different sizes in two shades. It will be seen from these that the method of grouping the lines, as well as the dimensions, determine the form of the pattern produced.

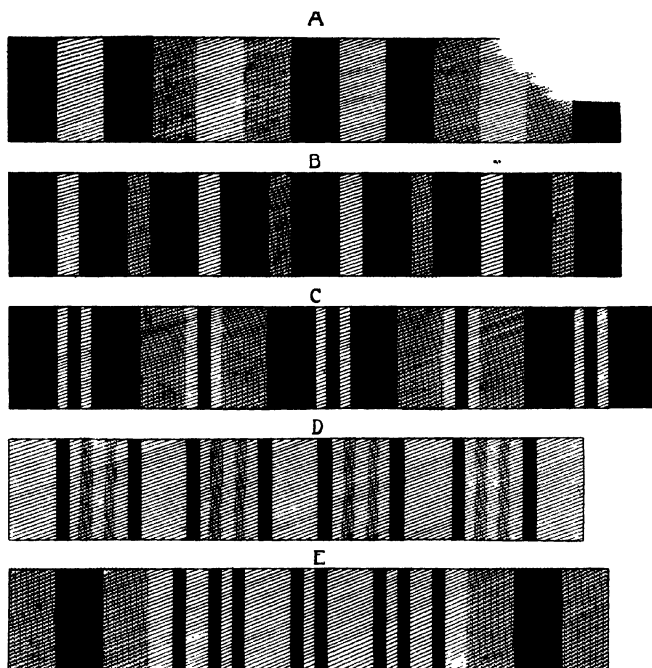


FIG. 12.—Stripe Patterns in Three Shades.

94. *Stripes composed of Three or More Colours* (Fig. 12, *B, C, D*, and *E*).—As a larger number of shade elements enters into this kind of stripe than that just described, it follows that the patterns are somewhat more intricate in composition. Yet, as the weaves used are invariably of the simplest type, and the widths of the stripes of different shades in the patterns may be the same, little technical complication occurs in their production. One illustration will sufficiently indicate the nature of this type (Regular stripes) of woven colouring, No. 3 on Plate XV. Four shades are present in this fabric—blue, tan,



slate, and crimson. The dark blue runs against all the shades and in this way an appropriate ground is produced on which the various shades may be developed. If slate were made the ground colour a totally different pattern would result; by changing the positions of the shades in this manner, a considerable range of styles is producible. These coloured examples and the forms of pattern in Fig. 12, show that this principle of colouring admits of extensive diversity of composition.

95. *Irregular Stripes composed of Black and White Yarns.*—

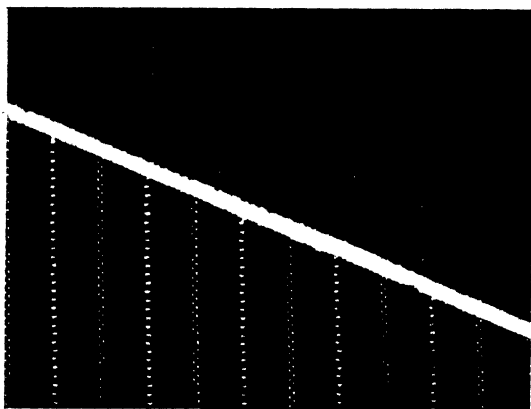


FIG. 13.

These patterns are far more diversified in construction than regular styles. Even when limited to the use of these shades, a great variety of design arrangement may be practised. The line stripe effects (Fig. 13) are woven in warp-face weaves, such as the ten-head buckskin (Fig. 13A) and weaves of the cord and corkscrew type. The warp colouring for the upper pattern is—

38 threads of 2-fold 60's black worsted,

2

fine white silk, or worsted and silk twist,

the weft being a dark shade. Of course, any other two shades might be employed, *e.g.*, Nos. 1 and 3, Plate IV., and No. 13 and No. 15, Plate VI.

As illustrative of the different effects that may be obtained in

the same shades, Fig. 14 may be compared with the previous styles. It is a pattern over an inch in width, and composed of bands of three sizes. There are, first, bands *A*, containing twelve threads each; then bands *b*, containing six threads each; and, lastly, the small lines of white of two threads each. There are twelve white stripes: eleven stripes *b*, and one stripe of *A*, in each repeat of the pattern. Both this style, and those in Fig. 13, are of a decided character.

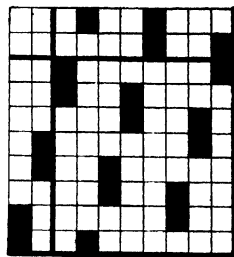


FIG. 13A.

Another type is that given in Fig. 14A. The dark grey, the grey, and the check lines of grey and white, all vary in size. There are, therefore, three types of effect: the centre stripe *A* has a dark line on each side adjoining the check stripe *B*; then follow stripes of grey and dark grey, gradually decreasing in size to line *C*, this being the order adopted on either side of the centre or leading stripe *A*. In one

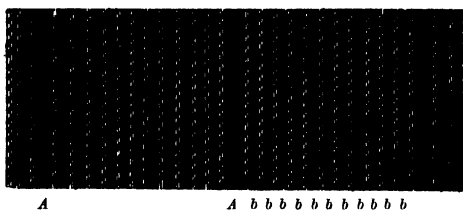


FIG. 14.

sense, this pattern is on the graduated principle of combining lines of different widths, and working in two colours at each change. Stripes in three shades may also be formed on the same base.

96. *Irregular and Indefinite Stripes in Two Colours*.—No. 1, Plate XVI, is, in one particular, constructed on a similar principle to the last illustration, for it contains a series of small stripes, nine in number, which in combination form one broad band; and then follows a small band of brown, each repetition of which determines the size of the pattern. It is a style



FIG. 14A.

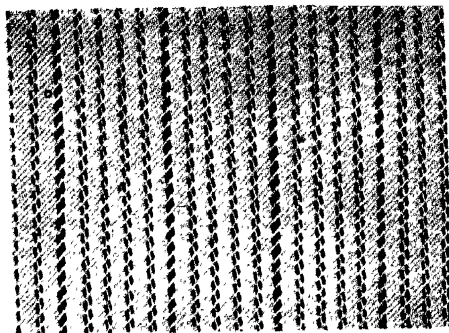
adapted to lawn tennis trouserings, flannels, and cotton fabrics. Though there is a marked contrast in the shades, yet the design is somewhat mellow and subdued. The arrangement of the warp colours is—

6 threads of white.	} For	36 threads.
1 thread of brown.		
1 „ white.		
1 „ brown.		
6 threads of white.		
3 „ brown.		

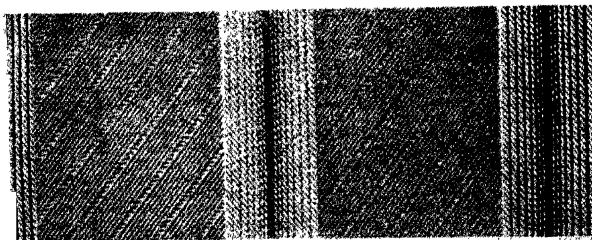
The occurrence of the three threads of brown after each forty-two threads causes the pattern to appear nearly an inch wide. If the centre end of these three threads were changed to white, the whole pattern would be like the part bracketed A; showing what a small item may modify the character of such styles. The white thread between the browns imparts the indefinite cast to the stripe. If this were removed the design would be pronounced and decided in arrangement. Indefinite stripes invariably result from distributing the colours in minute quantities in the fabric.

97. *Irregular Stripes—Shades in Two Colours.*—The principle of shading by colour yields a very useful range of woven patterns. These obtain in fancy dress fabrics, ulsterings, cottons, and, in small styles, in trouserings; just as shades are acquired in black and white in sketching, they may be produced in fabrics in any two colours by softly gradating one into the other. Generally an ordinary twilled weave is employed, and two colours of warp yarns, one of which must be dark

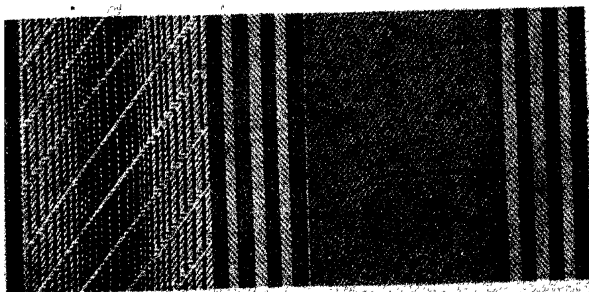
A



1



2



A

B

B

Plate XVI

FORMS OF IRREGULAR STRIPES

1. Tennis Stripes

2. Shaded Stripes

3. Compound of Ordinary and Shaded Stripes



and the other of a light shade. Thus, a shaded stripe of blue may be produced in the Venetian twill by grouping blue and white threads together, according to the plan given below:—

4 threads of blue cotton.	1 thread of blue cotton.
1 thread of white „	4 threads of white „
3 threads of blue „	2 „ blue „
2 „ white „	3 „ white „
2 „ blue „	3 „ blue „
3 „ white „	2 „ white „

This forms a lightened shade of blue. If black were used, a darkened shade of this colour would ensue. Any two colours of the same hue, but of different intensities, such as dark brown and medium brown, drab and light drab, when arranged on this principle, produce effective patterns.

98. *Shaded Stripes in Two Colours.*—Two excellent styles shaded on this system are supplied in Nos. 2 and 3, Plate XVI. The former consists of broad bands of fawn, and small bands of scarlet and white, and blue and white shades. The order of warping being—

4 threads of colour (red or blue).	4 threads of colour.
1 thread of white.	1 thread of white.
3 threads of colour.	1 „ colour.
1 thread of white.	1 „ white.
3 threads of colour.	2 threads of colour.
1 thread of white.	1 thread of white.
3 threads of colour.	2 threads of colour.
1 thread of white.	1 thread of white.
2 threads of colour.	3 threads of colour.
1 thread of white.	1 thread of white.
2 threads of colour.	3 threads of colour.
1 thread of white.	1 thread of white.
1 „ colour.	1 thread of white.
1 „ white.	1½ inches of fawn.



Next, consider No. 3, Plate XVI., a style containing a shaded stripe of more than an inch in width. While the principle of construction is the same as in the preceding example, it is

more intricate in arrangement, and comprises a larger group of threads. It is as follows:—

Blue and white stripe, Section *B* of No. 3, Plate XVI.

8 threads of blue.	}	For
8 „ white.		
		56 threads.

Shade of red, Section *A* of No. 3, Plate XVI.

5 threads of white.	
1 thread of red.	
4 threads of white.	
1 thread of red.	
4 threads of white.	
1 thread of red.	
3 threads of white.	} For
1 thread of red.	
16 threads.	
2 threads of white.	} For
1 thread of red.	
12 threads.	
1 „ white.	
1 „ red.	
1 „ white.	
1 „ red.	
1 „ white.	
2 threads of red.	} For 12
1 thread of white.	
threads  C	
3 threads of red.	} For
1 thread of white.	
16 threads.	
4 threads of red.	
1 thread of white.	
4 threads of red.	
1 thread of white.	
4 threads of red.	
1 thread of white.	
5 threads of red.	 → D
1 thread of white.	
4 threads of red.	
1 thread of white.	
4 threads of red.	
1 thread of white.	

3 threads of red.	}	For
1 thread of white.		
		16 threads.
2 threads of red.	}	For
1 thread of white.		
		12 threads.
1 „ red.		
• 1 „ white.		
1 „ red.		
1 „ white.		
1 „ red.	}	For 12
2 threads of white.		
		threads $\ggg \rightarrow E$
1 thread of red.	}	For
3 threads of white.		
		16 threads.
1 thread of red.		
4 threads of white.		
1 thread of red.		
4 threads of white.		
1 thread of red.		
5 threads of white.		

Section *B* of No. 3, Plate XVI.

8 threads of blue.	}	For
8 „ white.		
		56 threads.
1½ inches of drab.		

By this arrangement an elaborate shade is formed in two colours in Section *A*. It commences with a maximum degree of white, which gradually diminishes until a maximum quantity of red is acquired, when a similar decrease of red and an increase of white occurs, until the maximum white quantity is again reached. An analysis of the plan of colouring may explain how the softly-toned result has been produced. This commences with a 5 of white, then follows a 4 of white, and subsequently 3, 2, and 1 of white. Meantime the red has remained unaltered. At *C* a change takes place. Now the red begins to augment in quantity, while the white factor is invariable, consisting of one thread only. The red starts at this point *C* with 2, then 3, 4, and 5 in succession. Here the maximum intensity of this hue is reached. (See *D* in the order of colours.) From *D* to



*E* the red factor of the shade decreases, and from *E* to the end of the pattern the white increases. While the gradation of tinting in this pattern is complete, both sides of the shade are exactly symmetrical.

This style of striping might be adopted in fine cotton, silk, and worsted fabrics; other colours than those appearing in the illustration being of course employed.

99. *Irregular Stripes containing Several Colours.*—In this class of stripe are included many of the neatest patterns woven. Such stripes are generally mellow in colouring, and ingeniously diversified in arrangement. A number of shades may be combined, but the patterns should always be characterized by softness of tone.

This scheme of textile colouring is so important that further illustrations will be considered, two styles in dark, and two in light colours. Patterns 1 and 2, Plate XVII., show subdued stripings applicable to tweeds and similar fabrics, and in which there is diversity of line and of colour. No. 1 has a broad stripe *A*, on which there are lines of red, with the bulk of the stripe consisting of one-and-one colouring, and a second stripe *B*, of light olive. The warping and wefting are—

*Warp.*

White .	.	1	}	26	{	1	1	1	1	1	1	}	24
Black .	.	1	}		{	—	1	1	1	—	1	}	
Red .	.		.	—		1	—	—	—	1	—		
Olive .	.		.	—		—	—	—	—	—	—		4

*Weft.*

Black	.		.	38	7
Red	.	.	.	1	1

from which it will be seen that there are four colours with three types of stripes, the large stripe, the single-thread stripes in red, and the small stripe in light olive.

Pattern 2 is more diversified, and consists of the following warping and wefting:—

Warp.																			
Green and white twist	}	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
White	.	1	1	1	-	-	-	-	-	-	-	-	1	1	1	-	-	-	-
Slate	.	-	-	-	1	1	1	-	-	-	-	-	-	-	-	1	-	-	-
Silk	.	-	-	-	-	-	-	1	1	1	-	-	-	-	-	-	1	1	1
Orange and white twist	}	-	-	-	-	-	-	-	1	1	1	-	-	-	-	-	-	1	1
Fawn	.	-	-	-	-	-	-	-	1	1	1	-	-	-	-	-	-	1	1
Red	.	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-
Twice.																			

Wefit.

Black	.	.	98	1
Red	.	.	1	1

In the warp alone there are no less than seven colours, grouped to give harmony, as well as richness of style. Red, orange, and green twist are used, but no one colour has greater prominence than another; though the white silk threads form a feature of the pattern, the other colours blend and tone into each other. There is intermingling of colouring and of shades blending together, but the stripe characteristic is prevalent.

No. 2, Plate XVIII., is a style in silk in which five varieties of lines are combined, the ground being white, stripe *A*, with two widths of lines of heliotrope, *B* and *C*; lines in green, *D*, and in pink, *E*. The diversity of lines adds to the richness of the pattern. Had they been equal in size, there would have been stiffness of form and want of harmony of colour. The green and the pink would have been too pronounced in tone, but by adapting the width of the stripe to the brightness of colour, harmony and contrast are maintained.

No. 1, Plate XVIII., is still richer in colouring and in variety of stripe. There is, first, the simple striping of crimson and white in a series of lines, section *A*, with edging colour of gold of similar width. This is one pattern in itself, but in order to combine it with the second stripe *B*, without colour impinging upon colour, there is down either side dividing lines in white. Stripe *B* consists of four sizes of lines in addition to the white, in pale blue, pink, gold, and sage green. Again, there is variety of line with diversity of hue, the sizes of the stripes having been well worked out in proportion to the brightness of hue.

In such examples as Nos. 1 and 2, the style of striping has two applications: first, in other colours of the same depth and degree of contrast as those in the patterns, and second, in lesser or larger quantities of each colour, maintaining the same relative proportionate sizes of the lines.

100. *Shaded Stripes in Several Colours.*—Another system of shading, besides that already illustrated, consists in employing several shades of yarns of the same hue. For instance, to form a brown shade by this method, at least three or five tones—the larger the number the better, and the more complete the gradation—of this colour would be required, such as very dark, dark, medium, light, and very light brown. Each shade should be continued for a suitable number of threads, taking them in succession, and running from dark to light, and *vice versa*. But to obtain diversity of colouring in shaded styles economically, other methods are adopted besides this. An illustration in which the two methods are combined is given in No. 3, Plate XVIII. This is a compound of colours which gives shading in two varieties: first, that formed in the broad band *A*, in which there is a gradation from fine pink and deep maroon lines at the edges to lines increasing in width to the centre; and, second, the shaded stripe in green with fawn edges. The style is similar in principle to Pattern 3, Plate XVI., with the shading in section *B* more graduated, the green warp running from a pale green at the edges to a deep green in the centre. In section *A* the shading is due to the change in the grouping of the colours, and in *B* to the use of several tints of colour. The colour contrasts are in tone in stripe *A*, and also in *B*, and in hue between *A* and *B*, the whole pattern possessing harmony of colouring.

## CHAPTER VII.

### CHECK PATTERNS.

101. Utility of Check Styles—102. Principles of Checking—103. Several Styles of Checks. CHECKS COMPOSED OF TWO COLOURS—104. Forms of Checking in Two Shades—105. Common Check—106. Modification of Common Check—107. Check consisting of Two Sizes of Squares—108. Pattern composed of Solid Squares and of an Over-check—109. Counter-change Check—110. Compound Checking—111. Gradated Check—112. Broken Check in Two Colours—113. Basket Check. CHECKS COMPOSED OF THREE OR MORE COLOURS—114. Principle of Checking with Three Colours—115. Ordinary Three-shade Check—116. Set Check—117. Compound Checking in Three Shades—118. Counter-change Check in Three Shades—119. Interchanging Check—120. Counter-change with Over-check. SHADED AND IRREGULAR CHECKS—121. Shaded Check in Black and White in Cassimere Twill—122. Shaded Check in Two Colours due to using Designs composed of Various Weaves—123. Irregular and Mixture Checks—124. Fancy Broken Check—125. Examples in the Colouring of Tartans—126. Types of Tartans—127. Two-colour Plaids—128. Three-colour Plaids—129. Four-colour Plaids—130. Five, Six, and Seven-colour Plaids.

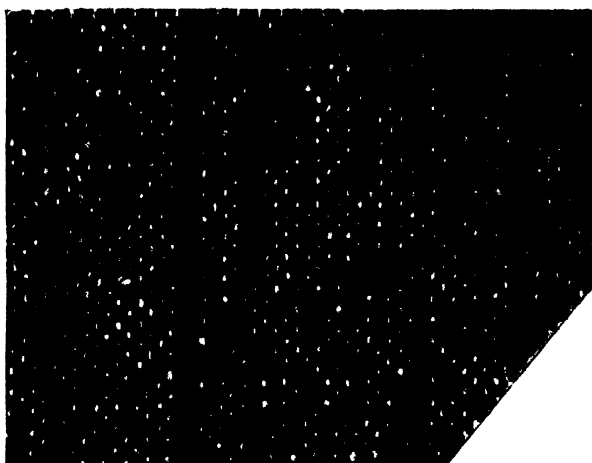
101. *Utility of Check Styles.* — Checks form one of the commonest types of patterns developed in woven goods. They obtain in all species of colouring, such as subdued and tempered shades, and bright and lustrous tints. They are characterized by diversification of arrangement, outline, and dimensions. As a rule, the check styles appearing in cotton, silk, and worsted yarns are clearer in pattern than those produced in woollen fabrics, which are frequently more or less indistinct and intermingled in composition. Possibly no form of design or method of grouping shades is more extensively worked than that of checking. It affords scope for novelty of pattern construction. Figured goods occasionally possess a checked surface of mellow colouring, on which the floral or geometrical design is distributed. Not infrequently this check groundwork enhances the fabric and pattern in which it occurs, giving diversity of surface to the

former, and developing with suitable precision the integral parts of the latter. But in addition to this principle of textile design being utilized in figured fabrics according to the system indicated, it is adopted in the construction of a wide series of styles. Shawls, mantlings, shirtings, flannels, suitings, coatings, dress fabrics, and other classes of textiles are coloured with this description of pattern. For dress materials and shawls, tartan and plaid checks are produced in a great variety of shades and systems of blending; in tweeds, ulsterings, and Irish homespun, somewhat loud and broad checkings are applied, generally soft in colouring. When suitings and coatings are considered, the checks are usually small in size and neat in colour.

Checks vary in size and form from minute squares to patterns consisting of solid squares of colour several inches in a repeat; and from compact rectangular spaces of colour to intermingled line patterns, but which still form a decided square or check design.

102. *Principles of Checking.*—There are many systems of checking, yet there are some principles of construction common to every class of check pattern. For example, whatever plan of colourings obtains in the warp, in order to make a perfect check the same set of colourings must be employed in the weft. This is the ordinary method of checking; it is the crossing of the warp shades with corresponding weft shades which constitutes the square or check divisions. All checks are formed of rectangular spaces of colours. Such designs may be defined as compositions of squares of various sizes of distinct shades fitting into each other to form a complete pattern. When producing these styles, the first work to be accomplished is the arrangement of the warp threads, which will determine the plan of the check. Supposing this to be, for instance, the pattern given in Fig. 14 on page 111, then, in order to convert it into a check, the same order of wefting as warping would require to be adopted, which would yield a large check of black—formed by the eight ends of this shade in the warp and weft—filled in with a series of outline checks of white surrounding solid squares of black; or consider the tartan plaid given on Plate X. It is a plaid comprising in each repeat several sets of checks or square divisions. First, there are the line checks of yellow, lavender, dark green,

A B



1



2

Plate XVII  
FANCY TWEEDS





and white; second, the squares of blue; third, the squares of carlet; and fourth, the main checks of green. These various squares are so combined as to make a perfect pattern, or one in which each rectangular space neatly fits into the squares of colour with which it interchanges. In producing such a fabric, the system of colouring the warp is primarily determined as indicated, the wefting being a counterpart of it; though not necessarily so, because the idea is rather to maintain the clear squares of colour than precisely the same number of shots or picks as threads per inch.

It will be obvious that on this principle any form of check may be acquired; for by colouring, say, the shaded stripes given on Plate XVI. in the weft as in the warp, shaded checks would result. There is, however, one technicality to be considered, which adds to the intricacy of this kind of pattern construction, namely, the weave of the fabric. So long as the weaves employed, float the warp and weft equally and regularly on the respective sides of the fabric, the same balance of colouring is acquired in both the direction of the warp and weft; but should the weave bring more warp than weft, or more weft than warp, on to the face, then whichever factor predominates, it will be impossible to obtain a check style in which both the warp and the weft colouring will be equally pronounced. If, for instance, Fig. 13 were changed into a check, in order to obtain the same precision of white colouring across as lengthways of the piece, some alteration in the structure of the weave would be necessary. This will be evident on consulting Fig. 13A, the plan of the weave of this striped fabric. It will be observed that this weave floats  $\frac{1}{4}$ ths of the warp to  $\frac{1}{4}$ th of the weft on the face; hence, if it should be used as here given, and the same order of colouring practised in the weft as in the warp, the white lines in the weft would be less distinct on the face than on the back of the cloth, for they only cover one thread out of five. To get a similar prominence of white in the weft as is seen in the warp of the fabric, the weave would have to be extended to twenty threads and picks, and the 19th and 20th picks modified in such a manner as to bring  $\frac{1}{4}$ ths of the weft to  $\frac{1}{4}$ th of the warp on the face of the texture. When, as in common twills and other



simple weaves, there are equal quantities of warp and weft yarns appearing on both sides of the fabric, no difficulties of this kind arise in converting a stripe into a check pattern. .

There are various kinds of "broken" checks in which the combination of warp shades is made to appear like a check by weaving it with some order of weft colouring, which, while forming a series of transverse lines of colour, will develop the fancy yarns in the warp which constitute the main element of such patterns. These, as well as other recognized types of checking, which are particularly effective in the woven fabric, and illustrative of the general principles of this class of textile colouring, will now be described.

103. *Several Styles of Checks.*—Check patterns may be classified under three heads, as follows:—

I. Checks composed of Two Colours.

II. Checks composed of Three or more Colours.

III. Shaded and Irregular Checks.

A considerable range of patterns is obtained in two shades; if the principles of checking with two shades are fully mastered, the more advanced species of check designs in which a large variety of colours obtains, will be readily understood. Indeed, it may be said that checks of three or more colours are elaborations of two-shade patterns. When a diversity of colours is employed, it does not follow that large quantities of each shade are used, but as a rule two shades compose the general cast of the pattern, while the additional hues are so many brightening factors. The art of checking consists in the skilful application of two or more shades, so that several useful schemes of grouping the threads in such patterns may be considered separately.

Intermingled and irregular checks are composed of square spaces of colour lacking clearness of character, and are useful for tweeds and certain classes of worsted goods.

#### CHECKS COMPOSED OF TWO COLOURS.

104. *Forms of Checking in Two Shades.*—These are illustrated in Figs. 15 to 23 inclusive. The illustrations furnished are typical of the different systems of combining two shades in

making check patterns. The forms of checking are, strictly speaking, unlimited. Beginning with the smallest check, consisting of two ends of a dark and two ends of a light shade alternately, the forms increase in intricacy and dimensions until patterns of several inches in size, and comprising several types of checking, are acquired.

105. *Common Check*.—The commonest form of check is given in Fig. 15. It results from arranging the warp and weft threads as follows:—

8	or any number of threads of black.
8	„ „ „ white.

Of course the number of threads of each colour, as well as the shades, may be varied. This style of check is worked in shep-

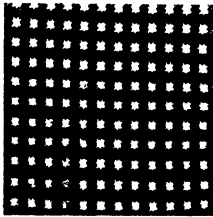


FIG. 15.

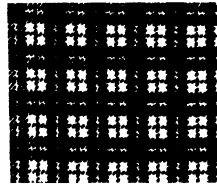


FIG. 16.

herd plaids and in other patterns, and in all kinds of materials. The weaves generally employed are plain, cassimere twill, and mat, each make giving suitable clearness to the colours.

106. *Modification of Common Check*.—Fig. 16 shows how, by a simple variation in the order of colouring the common check, it may be changed in character. This modification destroys the stiffness of the pattern. The plan of colouring in this example is as follows:—

8 threads of black.	8 threads of white.
2 „ white.	2 „ black.
8 „ black.	8 „ white.

An outline check of black is thus arranged to divide the squares of white into four sections, and an outline check of white to similarly divide the squares of black. It is a neat and useful form of pattern. Though only consisting of two shades, it com-

prises five effects, namely, solid squares of black, white, and squares of black and white equally mixed; and also of outline checks of black and white. Other colours besides those in which it is sketched are used in great variety, and it is a style applied with satisfactory results to rugs, shawls, dresses, cottons, woollens, and worsteds, being altered in size in the several fabrics according to the degree of loudness required.

107. *Check consisting of Two Sizes of Squares.*—Another valuable form of check, and one that is extensively utilized, is that in Fig. 17. It is a combination of two sets of squares of different sizes; it is given in the most elementary form, the plan of colouring being twelve threads of black and six threads of white, but it is rarely employed without being subjected to



FIG. 17.

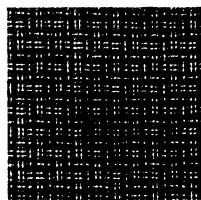


FIG. 18.

various modifications. Some of these modifications may be alluded to. In the first example, the large checks of black, and also of white, are bisected. This is done without increasing the shade, as follows (Fig. 18):—

5 threads of black.	2 threads of white.
2     "      white.	2     "      black.
5     "      black.	2     "      white.

In this way, the stiffness of the pattern is removed and a check obtained on the same base, but containing fuller variation of construction. Secondly, the square of black might be warped and woven thread and thread, while the square of white should remain solid, making a pattern suitable for flannel shirtings. One further modification to which this style is subjective, consists in bisecting the square of black or of white, but preferably the former, because it contains the largest number of threads.

108. *Pattern composed of Solid Squares and of an Over-check.*—An over-check is a small line of colour forming a skeleton square, filled in with solid squares of several shades. This base—illustrated in Fig. 19—is employed in dress fabrics, shawls, and ulsterings, and, in small effects, in suitings and mantlings. The yarns are arranged—4 threads of black, 2 threads of white, 4 threads of black, 10 threads of white, 10 threads of black, and 10 threads of white. The characteristic feature here is that only every alternate square of black is bisected, causing the small line of white which divides it to form an over-check equal in size to four of the black or white squares. This outline or skeleton check contains one solid square of black, four squares of white, and four squares of black and white twilled. It is a plan of check-

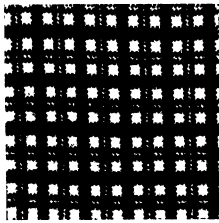


FIG. 19.

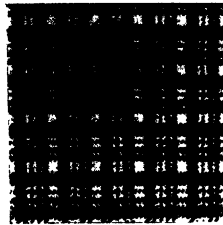


FIG. 20.

ing well adapted for plaids produced in two shades, and in such colours as blue and white, black and red, tan and medium blue (Nos. 2 and 7, Plate IV.), and lavender (No. 10, Plate IV.), and lilac (No. 16, Plate VI.). Fig. 19 is but a modification of the common check supplied in Fig. 15; for if the over-check were removed it would be reduced to precisely the same pattern. To obtain a change in this style, one of the squares of white is bisected with fine lines of black, leaving one black and one white check perfectly solid, but dividing one of the white checks into four equal sections. The order of colouring in such an instance would be thus (Fig. 20):—

10 threads of white.	4 threads of white.
10     "     black.	4     "     black.
4     "     white.	2     "     white.
2     "     •     black.	4     "     black.

This modified arrangement of Fig. 19 is one that is adopted in making this description of check in larger numbers of threads than here given, say twenty threads instead of the tens, and the other numbers similarly doubled. Patterns of these dimensions are mostly produced in bright or delicate colours for fabrics in fine worsted and cotton yarns.

109. *Counter-change Check*.—A counter-change check is a pattern in which the several sets of squares are exactly reversed; thus, in Fig. 21, the checks included in the bracket 1 are just the opposite in shade, but of the same size, as those grouped in bracket 2. It will be noticed that the principal square of black has one square of white at each corner, while the principal square of white has one small square of black at each corner,

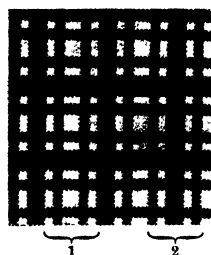


FIG. 21.

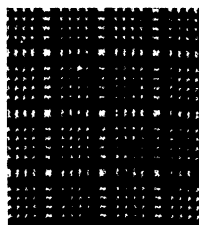


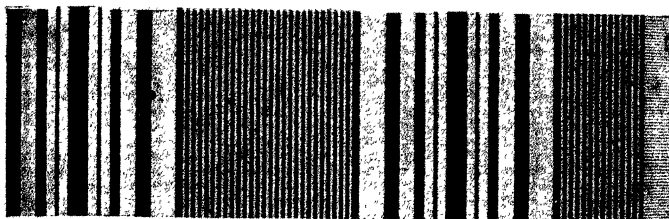
FIG. 22.

forming the counter-change which gives this species of checking its designation. The arrangement as here given, obtains development in various materials. It is modified in size according to the fabric to which it is applied. The colourings may be grouped as below:—

8 threads of black.	8 threads of white.
8     "      white.	8     "      black.
16     "      black.	16     "      white.

The style lends itself to numerous schemes of modification, but two or three can only be named. Firstly, bisect the large squares of black with small lines of white, and the large squares of white with fine lines of black; secondly, divide the small squares of the respective shades with black and white lines; and thirdly, combine these two systems of alteration.

110. *Compound Checking*.—This is one of the most useful



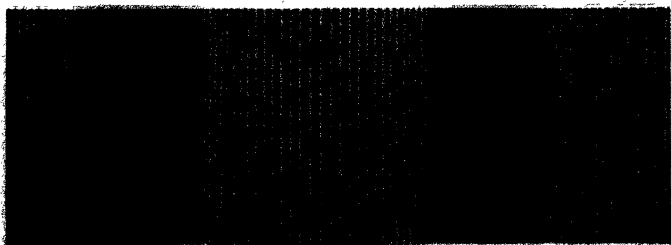
1

A B



2

A B A D A C E B



3

A B

Plate XVIII

COMPOUND STRIPINGS IN BRIGHT COLOURS



schemes of checking. The example given—Fig. 22—only contains two sizes of checks, but such designs may be composed of a much larger series of different-sized squares. Here the plan of grouping is also elementary, including a set of eighteen small squares of black and white separated by similar-sized checks of white and black twilled, and also a number of large checks of black and white. The colourings are arranged as appended :—

4 threads of black.	} For	
4 „ white.		24 threads.
8 „ black.		
8 „ white.		
8 „ black.		
4 „ white.		

In light shades and colours forming a mellow contrast, it makes a good style, being a check capable of development, and one that may be altered in several ways. Thus the single large square of white is divisible by two ends of black, which produce an over-check that considerably improves the whole pattern. Next, each of the squares of black should be divided with small lines of white, and lastly, both alterations should be combined.

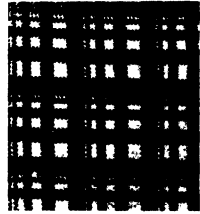


FIG. 23.

111. *Gradated Check*.—This style—Fig.

23—is not so largely employed as those described, but it gives an attractive pattern. The object of the arrangement is to graduate from a series of small to a series of large checks. In the fabric, the respective checks appear to run into each other. No less than eight sizes of squares occur in this example, varying from a check of two to sixteen threads, the order of colouring being thus :—

2 threads of white.	10 threads of white.
4 „ black.	12 „ black.
6 „ white.	14 „ white.
8 „ black.	16 „ black.

When using fine materials and high counts of yarns the series



of gradations is largely extended, continuing to checks containing as many as forty-eight and even sixty-four threads. Occasionally, the check is graduated from a maximum to a minimum size on both sides of the extreme large square, and not simply shaded off on one side as in the illustration.

112. *Broken Check in Two Colours*.—A species of irregular check in two colours is given in No. 1 on Plate XIX. The order of the threads is not intricate, being 8 threads of maroon, 8 threads of green, 2 threads of maroon, and 2 threads of green, and forms a mellow check style. This arises, first, from the corresponding strength of the two shades used; second, from the system of blending practised; and third, from the manner in which the weave distributes the threads. This pattern illustrates what neat effects may be acquired in two shades by an appropriate method of combining colours which contrast and harmonize. The style under consideration is composed of the contrasting colours green and maroon, which, when of corresponding intensities, as in this illustration, produce harmony. This is evident by the sense of completeness which characterizes the style when it is examined. It does not require any additional hue to brighten or freshen it, for it is apparently rich and mellow in colour composition.

The plan of grouping the shades causes the full checks of maroon and green to be in contact with each other, while the two threads of the respective hues give a shaded tone to the pattern—the colours seeming to vanish into each other. When making checks in which softness rather than loudness of effect is desirable, this toning of one colour into another is a very requisite element.

113. *Basket Check in Two Colours*.—Basket checks are obtained in two shades, and comprise two sizes of checking. They are produced in both four- and six-shaft twills, and also in fine yarns in the eight-end make. They contain four varieties of work, due to the manner in which the several sets of threads interlace with each other. A reference to No. 2, Plate XIX., will make it evident what is the nature of these effects. This is a basket check which has been woven in the cassimere twill, and in the order of threads which follows:—

For	{	4 threads of slate.
64 threads.	{ 4	„ white.
For	{ 2	„ slate.
48 threads.	{ 2	„ white.

The four-and-four grouping gives the shepherd-plaid effect bracketed A, and the two-and-two grouping the fine and minute checking bracketed B. The remaining effects in the pattern are due to the four-and-four wefting crossing the two-and-two warping—part C,—and the two-and-two wefting crossing the four-and-four warping in section D. In woollen, worsted, and other yarns this style of check is largely developed. In the illustration the sizes of the respective checks are not the same, the large plaid effect extending over 64 and the small plaids over 48 threads; but in some patterns they are exactly of the same dimensions. When the six-end twill is used, the shades are not grouped in fours and twos, but in sixes and threes, as in the example:—

For	{	6 threads of white.
48 threads.	{ 6	„ fawn or brown and white twist.
For	{ 3	„ white.
48 threads.	{ 3	„ fawn or brown and white twist.

One feature in colouring these checks is that no strong contrast of shades is suitable. Seeing that the system of grouping the shades is enough to produce ample diversity of style, loudness of colouring is unnecessary. From the illustration given, it will be seen that there is no marked distinction of hue in the colours combined. Such shades as white, and slate and white twist; white, and brown and white twist; and white, and blue and white twist, all yield patterns of the requisite depth of contrast. These examples are in light shades, but this type of checking also obtains an important place in dark patterns for ulstering and mantling fabrics.

#### CHECKS OF THREE OR MORE COLOURS.

114. *Principle of Checking with Three Colours.*—The principles of design and colouring involved in making check styles in three

shades are more intricate than those relating to checking with two colours. More ingenious patterns, fuller of detail and more diversified in composition, are producible with three than two shades. The third colour is important and valuable in toning and mellowing the check arrangement. Thus, supposing a light and dark shade formed the principal sections of a check composition, then by introducing into it a third and intermediate colour, increased softness of effect could be acquired and harshness of contrast obviated. Check arrangements of this class are employed in many types of woven goods, and are particularly useful in designing for some species of suitings, mantlings, cotton and silk fabrics. They are not so formal in cast as two-shade patterns, the square spaces of colour being better toned. Some of the most generally adopted systems of grouping the shades in these styles are represented in Figs. 24 to 32 inclusive. By



FIG. 24.

comparing them with the checks obtained in two colours given in Figs. 15 to 23, it will at once be evident that they contain a more complete range of effects and are more diversified in outline than the preceding examples. The function of the third shade and its utility in improving the aspect of the patterns will also be observed.

Fig. 25, for instance, though a simple arrangement, possesses a mellower character than any of the checks developed in two shades. The grey factor not only increases the multiplicity of effects appearing in the patterns, but enhances the value of the respective checkings by giving a softly-toned cast to them. Amongst the forms of check combinations illustrated in these figures are the common three-shade pattern, the set check, the compound base, the counter-change base, the interchanging base; and counter-change with over-check base.

115. *Ordinary Three-shade Check.* — The commonest and most elementary form of three-coloured checking is that in which the squares of colour are equal in size, *e.g.*, 10 black, 10 grey, and 10 white. When the squares of each colour are large, the check is satisfactory; but if they are minute, say

about four threads each, and composed of neat colourings, it is improved in character. Should the colours be dark, medium, and light, or black, grey, and white, a shaded check is formed of limited gradation. In greys, blues, browns, or slates, this arrangement makes a very useful form of pattern, and one that may be modified in various ways. It might, for example, be shaded off on both sides by allowing the intermediate shade to alternate with the dark and light colours. Another change may be effected by bisecting one of the squares of colour, say the black, with two ends of a lighter shade, in which instance one outline check would be obtained in each repeat of the pattern, which would give quite a new aspect to the style. If this idea of dividing the checks is further worked, a considerable range of appropriate modifications of this base may be acquired. Let one example be considered. Alter this form by arranging the shades as below (Fig. 24):—

4 threads of black.	4 threads of medium grey.
2 „ medium grey.	4 „ white.
4 „ black.	2 „ medium grey.
4 „ medium grey.	4 „ white.
2 „ black.	

According to this scheme the check would be completely changed, though the base remains unaltered. Each square of colour is here divided into four sections. The black checks are divided with an outline check of grey, the grey with an outline check of black, and the white with an outline check of grey. It will be clear from this method of modifying the simple order of colouring, that it is an elementary principle of grouping three shades to form a check which may be utilized in the development of fancy patterns.

116. *Set Check*.—A check pattern in which certain squares—namely, black in the illustration—form the main feature of the design, and are set at corresponding distances apart, with the respective shades alternately intervening, is supplied in Fig. 25. It is designated a “set” check, on account of the manner in which the large spaces of the leading shade in the

pattern are arranged, these repeating on such a principle as to give a stiff and "set" appearance to the pattern.

It is made in various dimensions, according to the style of fabric being manufactured. The size of the black check in lining and shawl textures ranges from eight to forty-eight threads, but in suitings and other materials it is frequently not more than six or four threads, and the spaces of grey and white proportionately reduced.

Taking the order of the shades to be 16 threads of black, 8 threads of white, 16 threads of black, and 8 threads of grey,

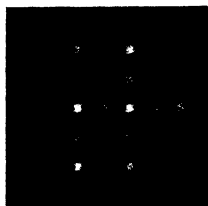


FIG. 25.



FIG. 26.

then one method of modifying this base practised with good results is (Fig. 26)—

6 threads of black.	}	= 16 black.
4   "   grey.		
6   "   black.		
2   "   grey.	}	= 8 white.
4   "   white.		
2   "   grey.		
6   "   black.	}	= 16 black.
4   "   grey.		
6   "   black.		
2   "   white.	}	= 8 grey.
4   "   grey.		
2   "   white.		

The centre of each of the squares of black would, by this means, be occupied with a square of four threads of grey, while the square of white would be outlined with skeleton checks of grey, and that of grey with skeleton checks of white. When this

system of alteration is adopted, a pattern fairly diversified in construction\* is the result.

117. *Compound Checking in Three Shades.*—Fig. 27 forms a neat principle of checking in three shades in which several series of small squares of colour are combined. The manner in which the small checks are grouped, obviates the stiff cast which characterizes some forms of checking. It will be observed that the several shades do not occur in uniform quantities. White is the main element, alternating with both black and grey; then comes black, of which there are three sets of checks, but only



FIG. 27.

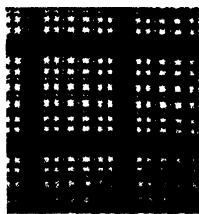


FIG. 28.

two sets of grey. To produce the pattern, the yarns are grouped as indicated below:—

8 threads of black.	16 threads of white.
8    "    white.	8    "    grey.
8    "    black.	8    "    white.
8    "    white.	8    "    grey.
8    "    black.	16   "   white.

The white not only produces minute checks, but also four large squares in each repeat of the design.

This base may be varied. One alteration consists in dividing the large squares of white with fine lines of black; another modification practised changes the single square of white, intervening the checks of grey, into black; while a third system of alteration bisects each of the checks of black with outline squares of white; then a fourth principle (Fig. 28) combines these several methods of utilizing this form, making a pattern constituted thus:—

3 threads of black.	Repeat.	4 threads of black.
2   "   white.		6   "   white.
3   "   black.		8   "   grey.
8   "   white.		8   "   black.
3   "   black.		8   "   grey.
2   "   white.		6   "   white.
3   "   black.		4   "   black.
6   "   white.		6   "   white.

If this last scheme is employed, the cast of the pattern undergoes considerable change, and is characterized by much variation of checking and intermingling of shades. By adopting three tones or tints of one colour, such as brown, olive green, or slate, this

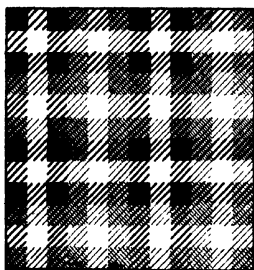


FIG. 29.

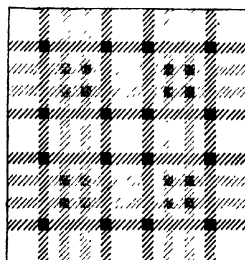
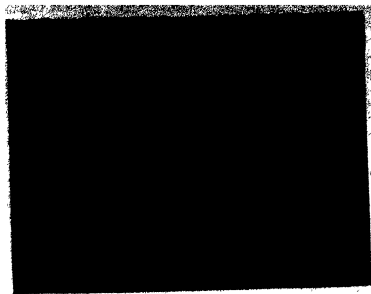


FIG. 30.

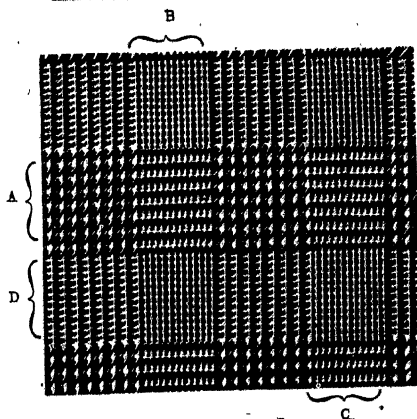
mode of checking is capable of being used in the construction of effective patterns for mantling, dress, and other fancy fabrics.

118. *Counter-change Check in Three Shades*.—The succeeding example (Fig. 29) is made up of equal quantities of black and grey and of a smaller portion of white. The checks of white are so introduced as to separate the four squares of black and also the four squares of grey, so that the white yarns form a comparatively large over-check. Both the black and grey threads, on the other hand, each compose two sets of checks working within one another. It is a base developed in cotton, worsted, and woollen yarns. One suitable plan of blending the shades is—8 threads of black, 8 threads of white, 8 threads of black, 8 threads of grey, 8 threads of white, and 8 threads of grey.

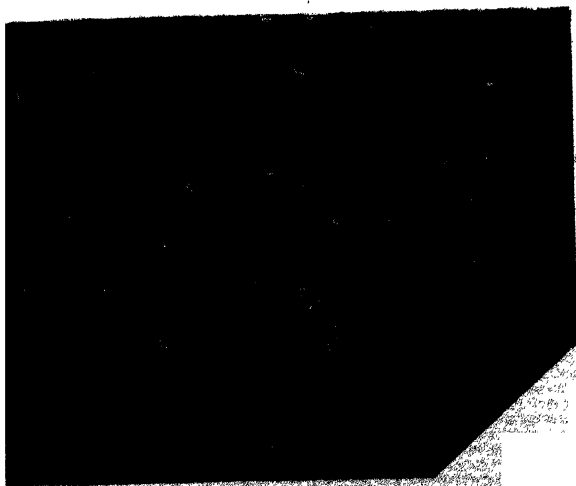
The style is susceptible of considerable elaboration. For example, the white check may be embellished with an over-check



1



2



3

# Plate XIX

## CHECK STYLES

Pattern in Maroon and Green

Compound Check

Small Interchanging check (Fancy Terms)





of black, the black squares with outlinings of white, and the grey with skeleton checkings of black or white.

119. *Interchanging Check*.—Three-shade checks on this base are illustrated in Fig. 30 and No. 3, Plate XIX. On examining Fig. 30, it will be seen that a group of small squares of black surround four similarly-sized checks of grey and nine of white. The grey and black checks interlace with each other. The principal shade in this pattern, white, is so arranged as to yield both small and large checks. It is a style which may range from a pattern of a fraction of an inch in suitings to six or eight inches in dress materials and shawl textures. When the following quantities are used, the base may be modified:—

12 threads of white.	6 threads of white.
6        „       black.	6        „       grey.
6        „       white.	6        „       white.
6        „       grey.	6        „       black.

Various systems may be practised in dividing up the twelve threads of white. To begin with, this group of ends may be changed to 2 threads of grey, 8 threads of white, and 2 threads of grey; or the four threads in the centre of the twelve may consist of 2 grey and 2 black; while a third variation would change the white square into 4 threads of white, 4 threads of black or grey, and 4 threads of white. If other changes of this base are required, the small squares of white should each be bisected with two threads of black, the checks of grey with two threads of white, and the checks of black with two threads of grey.

An application of this principle to costume fabrics is given in No. 3, Plate XIX. Three colours are used, light brown or fawn, green, and blue, the blue and green interchanging with each other. The brown is an intermediate shade, checking with both the green and blue. The warping and wefting are as follows:—

Light brown or fawn	. . . . .	4	2
Green	. . . . .	—	2
Blue	. . . . .	2	—

If the number of threads of each colour were doubled, some modifications could be applied: the eight threads of brown could

be bisected with an additional colour, and some further alteration made in developing both the green and blue sections.

120. *Counter-change with Over-check.*—Fig. 31 is a pronounced check form. It is mostly used in tartan patterns for cotton, fine worsted, and woollen-yarn dress fabrics. More variety of effect may be introduced into it by subdividing the main squares of black and white. Each of the spaces of white is in this instance split up by minute squares of black and lines of grey; and the

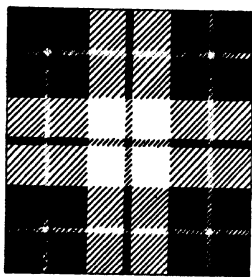


FIG. 31.

squares of black by minute squares of white in addition to the lines of grey in the illustration. This form of check is often made in very large patterns, some four or five inches in size, and in strongly contrasting colours, for which it is, by arrangement, well adapted.

It ought to be observed that all the examples described may be subjected to numerous modifications in sectional parts of the colouring, besides those quoted and analyzed. With a view of making it evident how the schemes of checking alluded to, are elaborated in practice, it has been shown to what an extent patterns of a check description are susceptible of variation in the loom. The principles of constructing these have been elucidated, and the chief forms of checking have been treated of.

#### SHADED AND IRREGULAR CHECKS.

121. *Shaded Check in Black and White in the Cassimere Twill.*—In the construction of shaded checks either two or more colours may be employed. With these, and a proper method of grouping the yarns, a pattern may be produced of a shaded character. The weave used, if the order of shade arrangement is diversified, must be of a simple type. An example will demonstrate the principle of developing this useful description of woven design. It is given in Fig. 32, and is a shade in black and white, the cassimere twill being the weave used in constructing the fabric. There are several features of this pattern which may be considered. Obviously it is a compound check,

combining both the ordinary and shaded schemes of checking. A set of common checks of a shepherd plaid type surround the shaded check proper. The shaded effect consists of three factors, which may be separately examined. In the square spaces, in which white is the main element, a light shade is acquired by gradually decreasing the quantity of black and increasing the quantity of white yarns until a perfect edging of white is acquired. Next there are lines of a deeper shade, due to the threads used in the composition of the principal check crossing those which occur in the shaded white checkings; and lastly, there is the broken square of black, which decreases by degrees in intensity from the centre to its respective edges. Though the shading as a whole is not uniformly continued, for there is a somewhat sudden change from dark to light

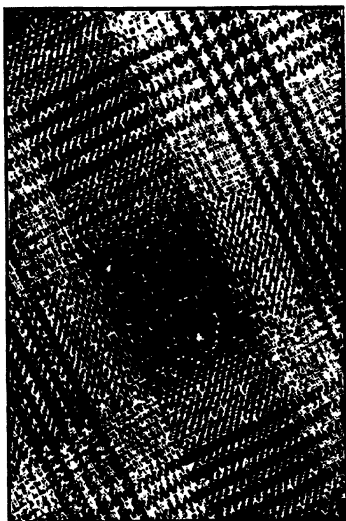


FIG. 32.

shading, yet at this juncture the effect obtained is softly toned. Mellowness of gradation is an important element of the pattern.

The irregular manner in which the white and black yarns appear, like specks on the surface of the fabric, arises from the employment of a print thread in which these shades alternate in lengths of about  $\frac{1}{8}$ ths of an inch. Solid black and white threads alone would not yield the intermingled effect so prominent in this style. They would produce a much stiffer and more uniform result. If this system of checking should be applied to woollen and worsted or cotton goods, twist yarns may be employed in place of the printed threads. These, in all species of designing, give more intermingled patterns than self-coloured yarns, and for this reason are useful in the production of shaded effects.

The plan of colouring this example is rather complicated, running as follows:—

4 threads of black.	}	For
4 „ white.		36 threads.
6 threads of white.	}	Repeat.
1 thread of print yarn.		A.
5 threads of white.	}	Repeat.
1 thread of print yarn.		
4 threads of white.	}	Repeat.
1 thread of print yarn.		
3 threads of white.	}	Repeat.
1 thread of print yarn.		
2 threads of white.	}	Repeat.
1 thread of print yarn.		
1 „ white.	}	Repeat.
1 „ print yarn.		
8 threads of print yarn.	→→ B.	
1 thread of black.	}	For
1 „ print yarn.		6 threads.
		C.
2 threads of black.	}	Repeat.
1 thread of print yarn.		
3 threads of black.	}	Repeat.
1 thread of print yarn.		
6 threads of black.	→→ D.	
1 thread of print yarn.	}	Repeat.
3 threads of black.		
1 thread of print yarn.	}	Repeat.
2 threads of black.		
1 thread of print yarn.	}	For
1 „ black.		6 threads.
8 threads of print yarn.	E.	
1 thread of white.	}	Repeat.
1 „ print yarn.		
2 threads of white.	}	Repeat.
1 thread of print yarn.		
3 threads of white.	}	Repeat.
1 thread of print yarn.		

- |                           |           |
|---------------------------|-----------|
| 4 threads of white.       | } Repeat. |
| 1 thread of print yarn.   |           |
| 5 threads of white.       | } Repeat. |
| 1 thread of print yarn.   |           |
| 6 threads of white.       | } Repeat. |
| • 1 thread of print yarn. |           |
- E.*

The light shade, which composes the squares consisting mainly of white, is formed by the threads included within *A* and *B*. This will be seen on examining the plan of colouring. At *A* there are six parts of white to one part of black and white print yarn; but at *B* there is a small quantity of print yarn only—the toning from extreme white to a complete mixture of black and white having been gradually effected by the intervening groups of shades. From *C* to *D* the dark shade is produced. Not containing as many changes as the light shade, it is more decided in composition. Practically this shade commences at *B*, which connects it with the adjoining gradated square of white and black. At *C*, however, the first move to black begins, for here black and print yarns are equally mixed. The number of black threads now increases until Section *D* is reached, when it begins to diminish, ultimately shading off to a group of print threads as indicated at *E*. From this stage the white shade is renewed, and continues to the end of the pattern.

Apart from its value as a principle of shading, this style is extremely suggestive of what may be accomplished by grouping two shades in woven fabrics of a simple or common twill class.

122. *Shaded Checks in Two Colours due to using Designs Composed of Various Weaves.*—These patterns are in some respects simpler to produce than the preceding class of check. There is no diversity of shade arrangement in such styles, the warp and weft being solid colours throughout. Now in an ordinary twill such colouring would not give any form of check, so that this is quite a distinct principle of checking. It is one that is applied to worsted, silk, and cotton, but not to woollen textures to any large extent. The combination of weaves necessary is not so well adapted for development in woollen, as in the other classes of threads named. Colouring being simple, the design is correspondingly intricate. If this is well con-

structed it will yield a shaded pattern, though the warp and weft yarns be of precisely the same colour, size, and quality. When this sort of shade is formed, a better effect is produced in such yarns as worsted and silk. Cotton or woollen threads would not give the same effect in designs arranged on the principle of a gradual movement from a maximum warp to a minimum weft flush, and inversely, as in Figs. 33 and 34. The essential of shading consists in diversity of tinting. A brown,

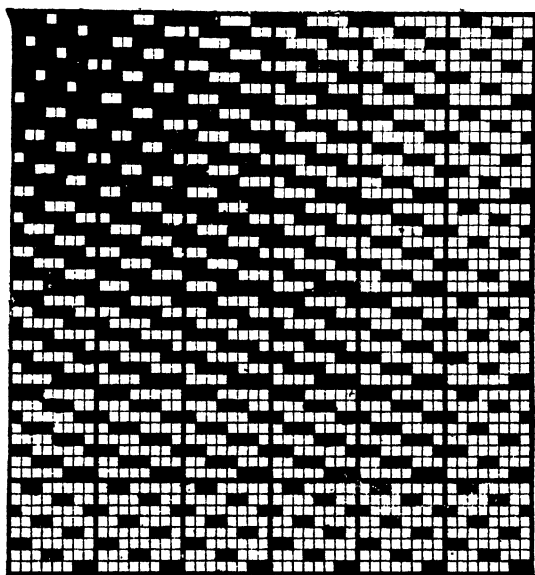


FIG. 33.

or any other shade, is producible if several colours of brown of variable depths are combined, but not otherwise. What in this instance is impracticable from a colour standpoint, is feasible by a suitable arrangement of weaves. The shade that may thus be produced is not, of course, so clear and pronounced as that due to a diversity of colouring, for it simply results from the difference in effect of the flushes of warp and weft yarns composing the pattern. As there is some visible distinction in the brightness of the floats of warp and weft respectively, if the weaves constituting the design are arranged on such a principle

as to tone one into the other, they produce an effect of a shaded type. According to the example furnished, one set of weaves which combines admirably on this method is that derived from a sateen base. But these are not the only weaves used, many varieties of twills being employed for similar purposes; but sateens give the most uniform shades of any class of weaves that can be utilized. On referring to Figs. 33 and 34, it will be seen that the weaves differ from each other in the extent to

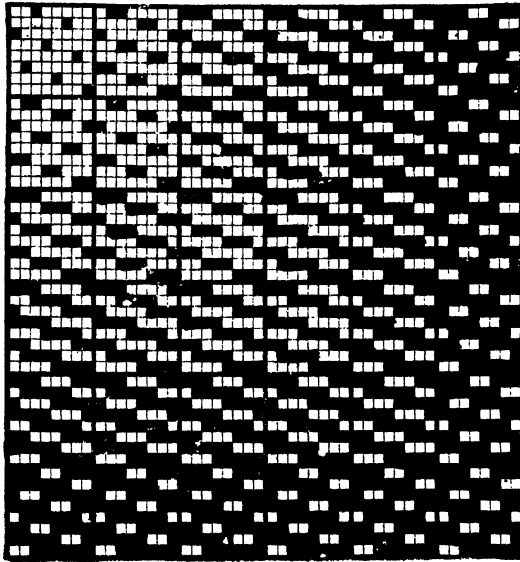


FIG. 34.

which they flush the warp and weft yarns on the face of the texture. To construct a shaded pattern of this kind, commence with the extreme warp-flush weave, adjoining which place the weave most closely approaching it in structure; the diminution in warp and the increase in weft flush continuing from one weave to another, until the extreme or maximum weft flush is attained. In such a scale of shades, the extreme warp- and weft-flush weaves represent opposite ends of the shade, the weaves intervening completing the gradation or toning of the pattern. The form or outline of the check is first decided upon, and then the



weaves combined according to the dark or light effect required in the various parts of the design.

This style of checking is determined by the system of arranging the weaves used, and not, as in the previous examples, by changing the scheme of colouring; hence this species of shaded check is extremely simple to produce, so far as the blending of colours is concerned.

A further application of this principle of weave shading in combination with a difference in the depths of colouring in the warp and weft is that developed in figured fabrics, of which

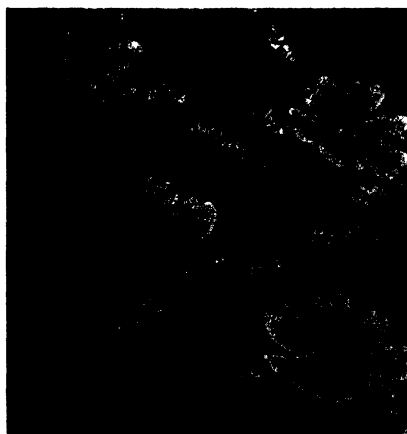


FIG. 35.

Fig. 35 is an example and Fig. 35A a section of the complete design. There are other weaves forming sections of the figuring, but they would give a pronounced warp or weft colour effect: that is to say, should the warp be a light or pale heliotrope, and the weft dark heliotrope, there would be perfect shading from the dark to light in the floral parts, but in other sections, marked in  $\square$ 's and  $\square$ 's, either a solid warp or weft colour would appear on the face of the fabric. The principle imparts definition to the colours used, and also to the integral parts of the design.

123. *Irregular and Mixture Checks.*—The styles of this checking, on account of their neat and subdued character, are produced in many classes of woollen and worsted fabrics. Two typical examples will be considered—Nos. 1 and 3, Plate XX.

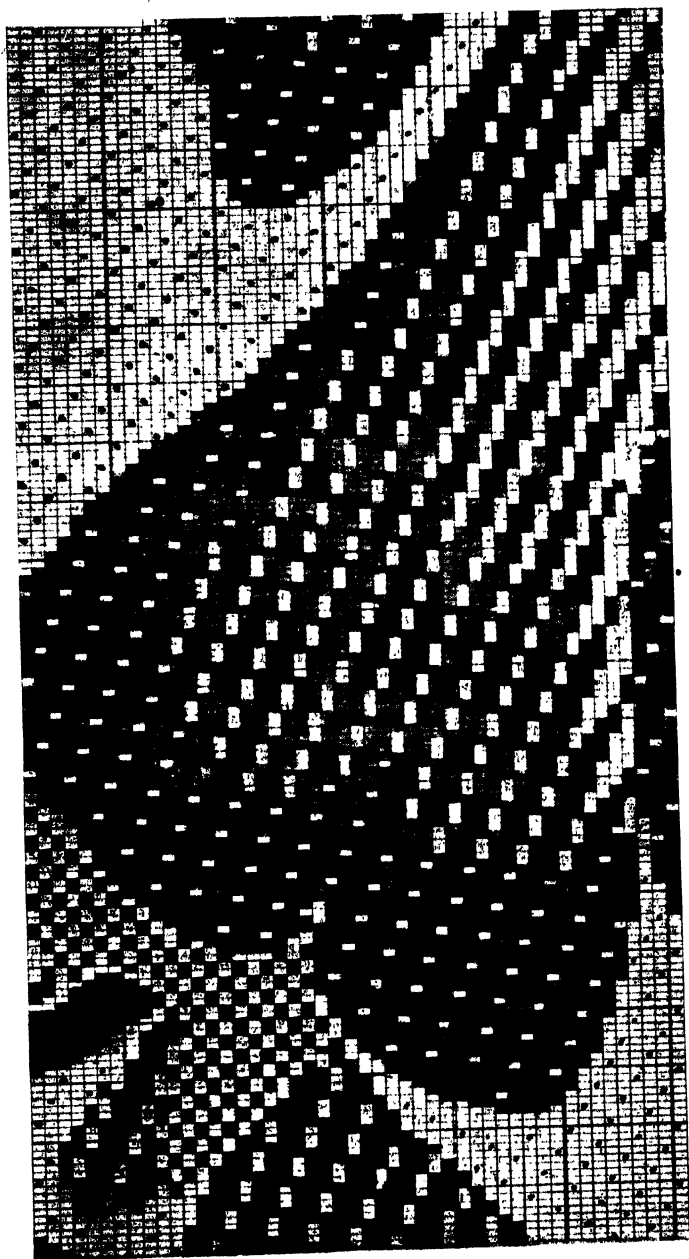


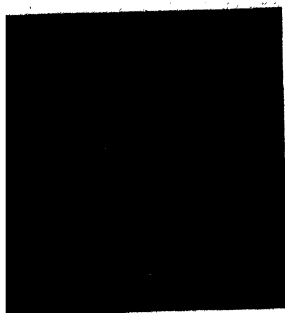
FIG. 35A.

No. 1 is an intermingled check in five colours, and possesses a black ground, the order of warp colouring being:—

- 3 threads of black.
- 1 thread of black and scarlet twist.
- 2 threads of black.
- 1 thread of black and green twist.
- 2 threads of black.
- 1 thread of black and scarlet twist.
- 3 threads of black.
- 2 threads of olive green.
- 3 threads of black.
- 1 thread of black and scarlet twist.
- 2 threads of black.
- 1 thread of black and green twist.
- 2 threads of black.
- 1 thread of black and scarlet twist.
- 2 threads of black.
- 3 threads of olive brown.

The method of wefting is much simpler than that of warping, consisting of 12 picks of black, 2 picks of olive brown, 12 picks of black, and 2 picks of olive green. The pattern is a combination of outline checks, enhanced with spotting threads of scarlet and black, and green and black twists. There is a skeleton check of olive green interlacing with a similar check of olive brown. The intensity of the two leading fancy colours ought in such patterns to be the same, as they should both be equally prominent in the texture.

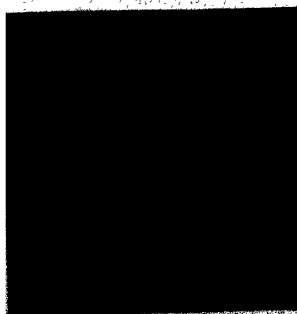
Next, as to the twist yarn or mixture check—No. 3, Plate XX. Here the pattern is composed of green and olive twist. On the intermingled mixture ground formed by these threads, is a small check of maroon. This hue forms a mellow contrast with the general colouring of the fabric. Twist yarns are chiefly suitable for yielding the rich and mellow indistinctness of effect seen in this example. The maroon is a solid colour and gives character to the pattern. For costume fabrics this scheme of checking, in both woollen and worsted fabrics, is well adapted, as it combines softness of colouring with neatness of pattern.



1

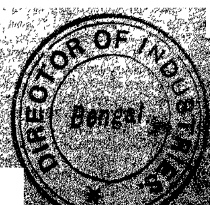


2



3

Plate XX  
CHECK STYLES  
1 and 2. Intermingled Effects  
3. Broken Check





124. *Fancy Broken Check*.—This is a species of check in which the plan of wefting differs from that of grouping the warp colours, the object being to produce a check-like effect more or less irregular in composition. No. 2, Plate XX., is one form of this sort of checking. A pattern composed of small checks is here obtained, analysis of the colourings showing the warp and weft to consist of different shades. Thus, while the order of warping is 5 threads of light fawn, 1 thread of green, 4 threads of slate, 5 threads of light fawn, and 5 threads of slate; the weft is 4 picks of black, 1 pick of scarlet, 5 picks of bluish grey, 5 picks of black, and 5 picks of bluish grey. The contrast between the warp and weft shades defines the weave, which, if the warp and weft colourings had been alike, would, in some parts of the pattern, have been indistinct.

The point to be observed in this type of colouring, is to employ shades of similar intensities in both warp and weft; thus, in this example, the slate is almost as prominent in the woven fabric as the black, the light fawn as the bluish grey, and the green as the scarlet. It is only by securing this balance of hues that harmonious colourings are producible in broken check patterns. Should any particular colour be stronger in character than others, it destroys some of the elements of the pattern. This principle of cross checking is also applied to various classes of striped fabrics, in which it is desirable to partially subdue the continuity of the warp colourings.

125. *Examples in the Colouring of Tartans*.—These may be defined as squares of colour varying in size and arrangement, and are, strictly, an elaborate scheme of check design entirely in colouring. One interesting feature of these plaids is that the colours are usually of the same depth or degree of intensity, as illustrated by the Erskine plaid, a compound of bright scarlet and green. These two contrasting and complementary hues form a good checking. It is not, however, always the case that complementary colours are blended; for instance, the Montgomery tartan is composed of green and blue, two colours which, if not of the proper hue and intensity, would produce an incongruous pattern. Hence, here, as in many other plaids, it is a question of using the correct depth and hue of colour.

Tartans illustrate the hues which combine harmoniously, and also the quantities or areas in which bright colours unite in a satisfactory manner.

As illustrations of this, the Macdonald and Hunting Menzies may be compared. In both, exactly the same colours are used, with entirely different effects. The Macdonald, in consequence of the large quantity of scarlet entering into its composition, is a bright plaid; whereas the Menzies is much softer and mellower in appearance. The larger the variety of colours, the more interesting the result in the pattern. If, for instance, the Duke of Rothesay, a three-colour tartan, is compared with the Hay, a five-colour one, the value of the larger number of hues in multiplying the diversity of colouring will be understood. Both are satisfactory compounds of coloured yarns, but the superior richness of the Hay is apparent. In each, red, green, and white are used, with the addition of black and yellow in the Hay. The Rothesay has a large square of red, divided with stripes of white, whereas in the Hay a similar space of red is subdivided with stripes of white, black, and green. In the Rothesay the green sections are crossed with lines of red; but in the Hay, with lines of yellow and red, forming a check rich in colouring.

126. *Types of Tartans.*—Tartans may be classified as follows:—

1. Plaids in two colours.
2. Plaids in three colours.
3. Plaids in four colours.
4. Plaids in five colours.
5. Plaids in six and seven colours.

It is difficult, on account of the varied colouring, to classify them according to hue; but the above subdivision comprises all the tartans, and makes it feasible to deal with them in a natural order, or in accordance with their colour composition.

127. *Two-Colour Plaids.*—Amongst the most important of the two-colour tartans are the Menzies, Douglas, Montgomery, Macdonald, and the Erskine. The Menzies is produced in red and white, red and black, black and white, and red and green, the last being termed the Hunting Menzies.

The black and white Menzies, in its original form, is illustrated

in Fig. 36, the order of shades in both warp and weft being as follows:—

Black	.	.	96	12	24	6	6	24	12
White	.	.	16	16	8	36	8	16	16

It is a forcible scheme of checking which may be developed on various lines. Two changes which affect the appearance of the check are given. In the first (Fig. 37) the largest quantity of one colour—the 96 of black—has been modified:—

4 black.	} For 16.	4 white.	} For 16.
4 white.		4 black.	
64 black.			

This slightly subdues the form of the check, which would be

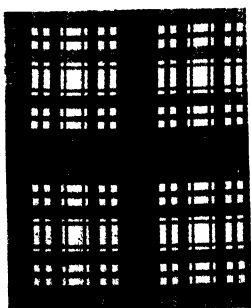


FIG. 36.

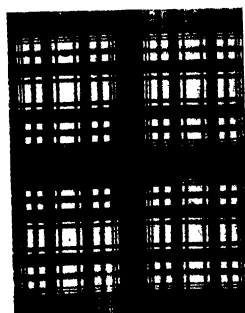


FIG. 37.

more apparent if the lines added were of a different colour from the rest of the pattern. The second change to form an over-checking is applied to the 12 threads of black in the centre of the squares of white:—

1 black.	} For 4.	1 white.	} For 4.
1 white.		1 black.	
4 black.			

Again, by having the odd threads in a bright colour, the tone of the pattern would be improved.

Another example, namely, the Montgomery (Fig. 38), with the derivations obtainable on this base, may be considered. It is composed of a peculiar hue of grass green and blue. The blue, however, by its softness and warmth of hue, arising from its



purplish tone, makes a subdued contrast with the green. The colours being about equal in intensity, are combined in similar quantities. In a smaller checking, with the blue slightly predominating, this plaid would make a good lining style, especially in mantles where the face of the cloth may be a warm colour, such as deep fawn. The warping and wefting for Fig. 38 are:—

Green (black)	.	.	.	144	16	16
Blue (grey)	.	.	.	48	48	48

In Figs. 39 and 40, two simple changes, showing how the

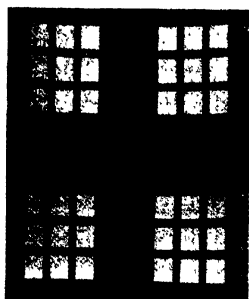


FIG. 38.



FIG. 39.

pattern may be altered in appearance, are given. In the former, the centre 48 threads of blue have been subdivided into

20	threads of blue (grey),
8	„ green (black),
20	„ blue (grey),

whilst in the latter, the 16 threads have been changed to

6	threads of green (black),
4	„ blue (grey),
6	„ green (black).

The check should be further modified in the large square of 144 threads of green, working either from the edges to the centre, or *vice versa*, one scheme being as follows:—

Green (black)	.	.	.	24	16	8	16	24
Blue (grey)	.	.	.	8	20	20	8	-

The Grey Douglas is an effective pattern in black and grey yarns. As a basis of checking, it is simple in arrangement, and of such a character as to be capable of numerous modifications.



FIG. 40.

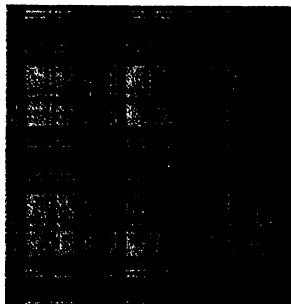


FIG. 41.

In fine yarns and close setting, it might be used for dress materials, in worsted yarns for linings, and in woollen yarns for rugs and shawls: in thick and soft spun yarns, it would be also

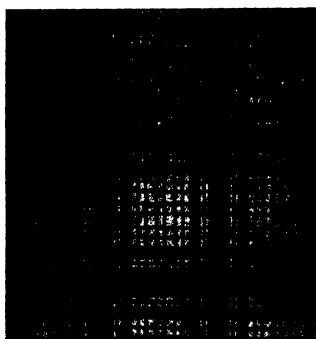


FIG. 42.

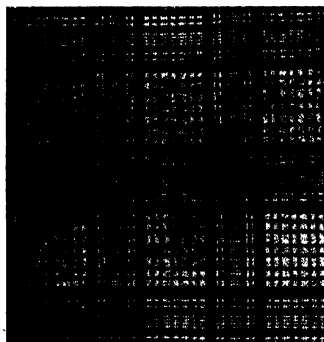


FIG. 43.

suitable for travelling rugs. A standard form of this tartan is sketched in Fig. 41, the warp and weft being:—

Black	.	.	-	4	4	16	4	32	4	16
Grey	.	.	.	36	8	36	4	4	4	-

Figs. 42 and 43 give some idea of the diversity of style obtain-

able by extending the colouring. The form of this check makes it desirable, in combining other colours than black and grey, that there should only be a small degree of contrast between the shades, the best patterns resulting when the colours are of the same hue.

When the plaid is developed on the lines illustrated in Figs. 42 and 43, it suffers somewhat in simplicity of character, but still makes an excellent pattern for linings, and in fine yarns for dress materials. The broken-up effects in these two checkings admit of more pronounced colour contrasts than are feasible in colouring Fig. 41. The sub-division of the various sections of 36 threads of grey has been acquired thus:—

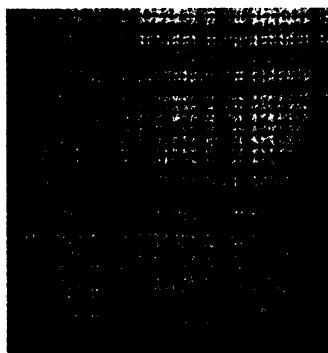


FIG. 44.

8 threads of grey.  
4 „ black.  
8 „ grey.  
4 „ black.  
12 „ grey.

Fig. 43 results from dividing the 32 threads of black:—

8 black.  
1 grey. } For 16.  
1 black. }  
8 black.

By changing the weave from 4- to 6-end twill, a very different colour effect is obtained, as shown in Fig. 44.

128. *Three-Colour Tartans*.—These form an important variety, and may be considered under two heads,—the bright plaids, of which the Gow, MacLeod, Duke of Rothesay, Cuninghame, Brodie, Wallace, MacQueen, Crawford, Hamilton, Ross, MacIntosh, Maxwell, Dunbar, Skene, and Mathieson are examples; and the dark plaids, including the Clergy, Hunting Mathieson, Keith, Hunting MacLean, MacArthur, and Elliot.

The following are the orders of colouring for the MacQueen, the Hamilton, and the Maxwell:—

## MACQUEEN (Fig. 45).

Black (black)	.	.	8	8	8	64	64
Red (grey)	.	.	28	28	28	-	28
Yellow (white)	.	.	-	-	-	6	-

Two modifications of this tartan are given in Figs. 46 and 47, and show how the base is adapted for detailed checking.

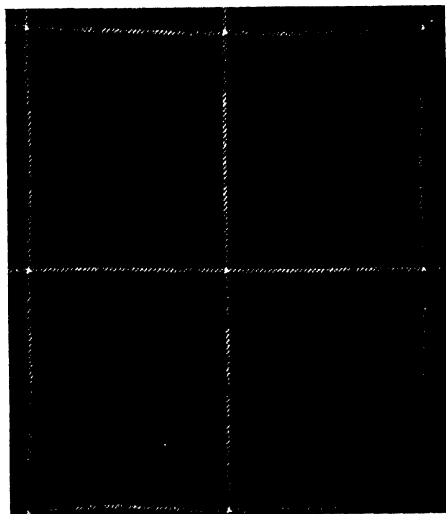


FIG. 45.

## HAMILTON (Fig. 48).

Scarlet (medium grey)	.	.	60	60	16	16
White (white)	.	.	12	-	-	-
Blue (black)	.	.	-	36	36	36

## MAXWELL (Fig. 49).

Scarlet (medium grey)	.	.	54	8	54	12	12	12
Green (light grey)	.	.	4	4	-	28	28	-
Indigo blue (black)	.	.	-	-	12	-	-	12

These tartans are examples of colouring in which red or scarlet is the most important colour employed.

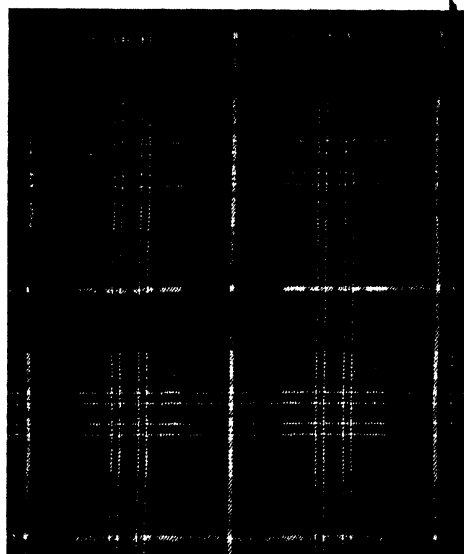


FIG. 46.

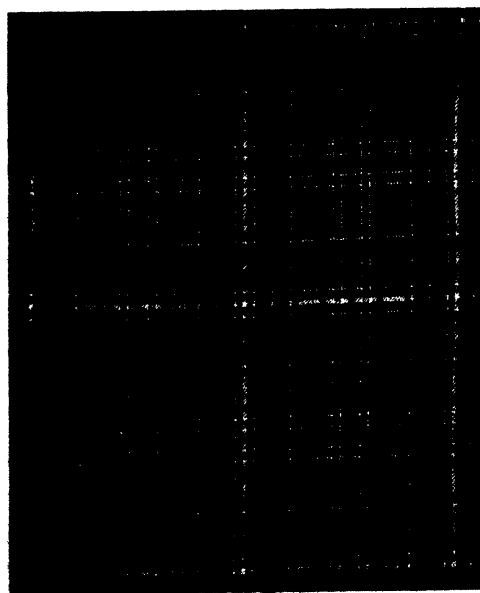


Fig. 50, the Elliot, is not of this class, for it is composed of blue, brown, and a small band of scarlet, the red being used to give cheerfulness of tone. The order of colouring is:—

Blue (grey)	.	.	.	216	32	32
Brown (black)	.	.	.	64	—	64
Scarlet (white)	.	.	.	—	12	—

It is a simple check, yet is exactly of that type which is capable of interesting development by modification.

129. *Four-Colour Plaids*.—Three of the most interesting tartans of this class, whether produced in neutral shades or

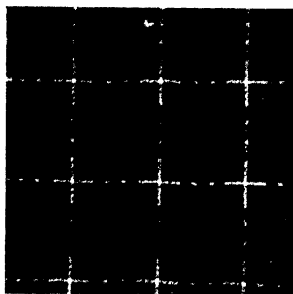


FIG. 48.

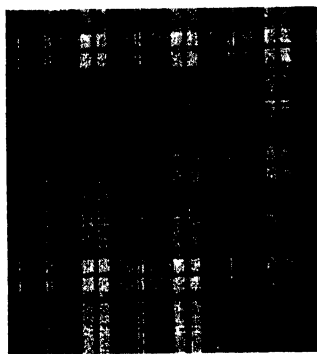


FIG. 49.

in the original colourings, are the MacKinnon, Dundas, and Fraser. They have few elements in common, as comparisons of Figs. 51, 54, and 57—the plaids in the unmodified forms—distinctly show. The MacKinnon in particular is characterized by simplicity of form and scheme of colouring; the Dundas is a heavier base; and the Fraser full of details and of shade contrasts. They are also dissimilar in colour qualities. The MacKinnon and Dundas are both dark plaids, the former being composed of brown, green, scarlet, and white, and the latter of black, green, scarlet, and blue. The Fraser is an admirable compound of scarlet, black, green, and white. The following are the orders of colouring for the respective tartans, with their modifications:—



## THE DUNDAS (Fig. 54).

Black = black	.	.	.	40	8	40	-	8	-
Blue = medium grey	.	.	.	40	40	-	-	-	-
Green = light grey	.	.	.	-	-	64	8	8	64
Scarlet = white	.	.	.	-	-	12	-	12	-

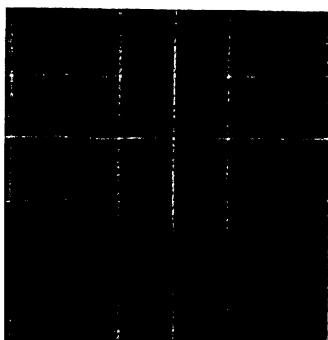


FIG. 52.

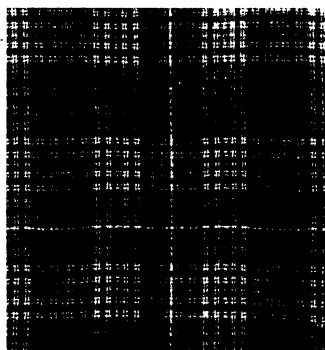


FIG. 53.

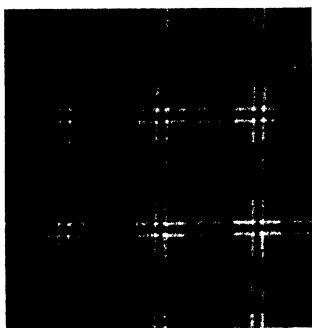


FIG. 54.

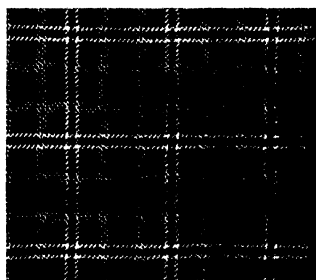


FIG. 55.

## DUNDAS—FIRST MODIFICATION (Fig. 55).

Black .	.	4	4	-	4	4	-	8	-	-	-	8	-
White .	.	4	4	4	4	-	-	-	-	-	-	12	- 12
Med. grey .	.	-	8	-	-	-	40	40	-	-	-	-	-
Light grey .	.	-	-	-	-	-	-	-	-	-	-	64	8 8 64

•  
A



## DUNDAS—SECOND MODIFICATION (Fig. 56).

Black	4	4	-	4	4	-	8	-	2	-	-	-	2	-	8	-
White	4	4	4	4	-	-	-	-	-	4	4	4	-	12	-	12
Med. grey	-	8	-	-	-	40	40	-	-	-	-	-	-	-	-	-
Light grey	-	-	-	-	-	-	-	-	10	10	4	4	10	10	8	8
	A								B							
								Repeat A								Repeat B

## THE FRASER (Fig. 57).

Green = mid grey	.	.	24	-	-	24	-
Scarlet = light grey	.	.	12	12	12	48	48
Blue = black	.	.	24	24	-	-	-
White = white	.	.	-	-	-	12	-

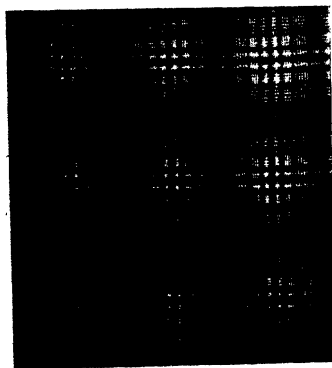


FIG. 56.



FIG. 57

## FRASER—FIRST MODIFICATION (Fig. 58).

Light grey	.	.	8	6	6	8	-	-	12	12	12
Black	.	.	4	-	4	-	-	Repeat A	-	24	24
White	.	.	-	12	-	-	12	-	-	-	-
Mid grey	.	.	-	-	-	-	-	-	24	-	24
			A								

## FRASER—SECOND MODIFICATION (Fig. 59).

Light grey	.	.	8	6	6	8	-	-	-	-	12	12	12
Black	.	.	4	-	4	-	-	Repeat A	-	-	24	24	-
White	.	.	-	12	-	-	12	-	4	4	4	-	-
Mid grey	.	.	-	-	-	-	-	-	4	4	4	-	-
			A						B				
								Repeat A					Repeat A

130. *Five, Six, and Seven-Colour Plaids*.—These are much more limited in variety, but the following may be given as examples:—

## CLAN ALPIN (FIVE-COLOUR).

Black . . . . .	.	.	-	-	32	32	-	-	6	-	-
Indigo blue . . . .	.	32	-	-	-	32	8	-	8	-	-
Green . . . . .	.	.	-	-	6	-	8	36	36	-	8
Yellow . . . . .	.	.	-	6	-	-	-	-	-	-	-
White . . . . .	.	.	-	-	-	6	-	-	-	-	-

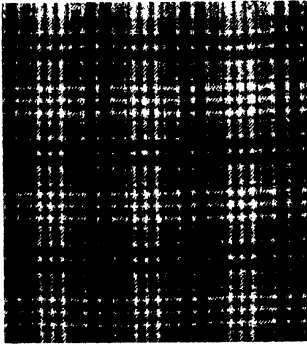


FIG. 58.

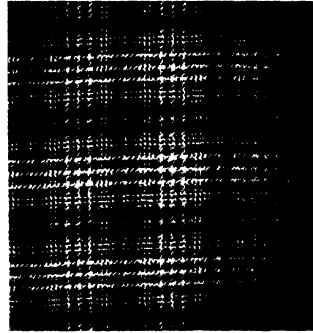


FIG. 59.

## ROYAL STUART (SIX-COLOUR).

Black . . . . .	-	20	-	10	-	10	-	-	8	-	-	8	-	-	10	-	10	-	20	-	-
Blue . . . . .	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16	-
Green . . . . .	-	-	-	-	-	40	-	-	-	-	-	-	-	40	-	-	-	-	-	-	-
Scarlet . . . . .	-	-	-	-	-	-	20	-	8	-	8	-	20	-	-	-	-	-	-	-	220
Yellow . . . . .	-	-	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8	-	-	-
White . . . . .	-	-	-	-	8	-	-	-	-	-	8	-	-	-	-	8	-	-	-	-	-

## MACLEAN (SEVEN-COLOUR).

Black . . . . .	-	6	-	6	-	12	-	-	12	-	6	-	6	-	-	-	-	6	-	-	-
Indigo . . . . .	-	-	-	-	-	-	24	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Green . . . . .	36	-	-	-	-	-	-	-	-	-	-	-	-	-	36	-	-	-	-	-	-
Scarlet . . . . .	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	56	-	8	-	8	-
Yellow . . . . .	-	-	-	4	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-
White . . . . .	-	-	6	-	-	-	-	-	-	-	6	-	-	-	-	-	-	-	-	-	-
Lavender . . . . .	-	-	-	-	-	6	-	6	-	-	-	-	-	-	-	6	-	-	-	6	-

In the exposition of tartans given, it has been shown that this scheme of colouring is not only useful in the production of the original plaids, but that it may be subjected to almost an endless

series of modifications. Many of these, as well as the plaids themselves, when developed in subdued colourings, are suitable for styles in dress and mantle fabrics. In recent years they have also been developed in the foundation of plush and other textures. They are specially suitable for such textures, inasmuch as the contiguity of the figuring formed in velvet or loop pile destroys any stiffness of character which lines of colour, cutting each other at right angles—as in all check patterns—must more or less possess. To the student of colour contrast and harmony these patterns are interesting and suggestive. They are illustrative, not only of how bright colours may be blended without yielding patterns in which the contrasts are displeasing, but also of the quantities of the colours which give the most harmonious composition. As they are distinctly textile colourings, and are the product of weaving, they possess qualities which are not to be found in any other type of colouring. The field which has been covered has by no means been fully explored. There are many possibilities in this branch of textile work which can only be analyzed by systematic experiments conducted in the loom.

## CHAPTER VIII.

### SIMPLE COLOURINGS.

131. Simple and Compound Colourings—132. Regular Simple Colourings—133. One-and-One and Two-and-Two Systems—134. Figured Styles in Common Weaves and One-and-One Colouring—135. Utility of the One-and-One Principle in Figured Textiles—136. One-and-One and Two-and-Two Colourings in Fancy Weaves—137. Three-and-Three Colouring—138. Four-and-Four Arrangement—139. Four-and-Four Method applied to Fancy Weaves—140. Six-and-Six and Eight-and-Eight Schemes—141. Six-and-Six Colouring in Various Crossings—142. Three-Odd-Thread Arrangement—143. Various Three-Shade Patterns—144. Simple Colourings composed of Four Shades—145. Irregular Simple Colourings—146. Irregular Simple Patterns in Two Shades—147. "Irregulars" composed of Three Shades—148. "Irregulars" composed of Four Shades—149. Cross-weftings.

131. *Simple and Compound Colourings.*—As in Weave Design there are two important types of pattern—such as effects resulting from the use of one crossing, and effects due to combining several crossings—so the styles obtained by blending fancy shades are also of two kinds, and may be designated *Simples* and *Compounds*. Both classes are divisible into *Regular* and *Irregular* orders of colourings. In the *Regular* order of Simple colourings, the colour elements are of equal quantities and systematically alternate; but in *Compounds*, the shades may occur in various quantities and be irregularly distributed. If, for example, a pattern were arranged—

2 threads of black,	2 threads of blue,
2        „        brown,	2        „        slate,

it would be a Simple colouring, because it is composed of similar numbers of each sort of yarns, and the respective shades regularly succeed each other. The same shades could be made to form an *Irregular Simple* pattern in two ways: first, by diversi-

fying the plan of the colours in such a manner as to allow any one or more shades to intervene the other shades, as follows:—

2 threads of black,	2 threads of blue,
2 „ brown,	2 „ brown,
2 „ black,	2 „ slate;

and second, by retaining the original order of succession of shades, but by varying the quantities in which they occur, as illustrated below:—

8 threads of black,	4 threads of blue,
6 „ brown,	2 „ slate.

Here are two types of Irregular and Simple colourings, viz., those in which the shades are grouped in similar quantities but are irregularly combined, and those in which the shades obtain in different proportions, though following in regular order.

To convert the same group of shades into a Compound colouring, it is only necessary to combine two or more systems of blending the yarns, as follows:—

For	{ 4 threads of black.
16 threads.	{ 4 „ brown.
For	{ 2 threads of blue.
16 threads.	{ 2 „ slate.

From this example it will be observed, that in making a Regular Compound at least two systems of elementary colouring are combined: in this instance, the four-and-four and the two-and-two methods have been selected. Compounds necessarily give more diversified styles of pattern than Simples; but unless the effects of the latter have been studied, the arrangement and composition of Compounds cannot be fully understood. Simple colourings are the elements of all Compounds. In order to obtain well-balanced effects in designs consisting of various weaves, the construction and woven result of each weave have to be considered, and only such makes united as will yield symmetrical patterns and regularly-built fabrics; and similar laws determine the association of shades as determine the combination of weaves.

132. *Regular Simple Colourings.*—The principal forms of Elementary\*Simple Colourings are comprised in the three classes given in the table appended:—

TABLE IX.

• REGULAR SIMPLE COLOURINGS.

CLASS A.—COMPOSED OF TWO SHADES.

<i>I. Scheme.</i>	<i>II. Scheme.</i>
1 thread of black.	2 threads of black.
1 „ white.	2 „ white.
<i>III. Scheme.</i>	<i>IV. Scheme.</i>
3 threads of black.	4 threads of black.
3 „ white.	4 „ white.

CLASS B.—COMPOSED OF THREE SHADES.

<i>I. Scheme.</i>	<i>II. Scheme.</i>
1 thread of black.	2 threads of black.
1 „ grey.	2 „ grey.
1 „ white.	2 „ white.
<i>III. Scheme.</i>	<i>IV. Scheme.</i>
3 threads of black.	4 threads of black.
3 „ grey.	4 „ grey.
3 „ white.	4 „ white.

CLASS C.—COMPOSED OF FOUR SHADES.

<i>I. Scheme.</i>	<i>II. Scheme.</i>
1 thread of black.	2 threads of black.
1 „ medium grey.	2 „ medium grey.
1 „ light grey.	2 „ light grey.
1 „ white.	2 „ white.
<i>III. Scheme.</i>	<i>IV. Scheme.</i>
3 threads of black.	4 threads of black.
3 „ medium grey.	4 „ medium grey.
3 „ light grey.	4 „ light grey.
3 „ white.	4 „ white.

It is not needful to increase the number of these examples, for it will be observed that in each scheme of the several classes given,

the order of colouring is identical, but that the quantities of the shades are systematically enlarged. In fine fabrics, the number of threads of each colour might be increased; but in these examples, the bases of all styles of Elementary and Compound Colourings are enumerated. On this account they will be considered separately, and the effects of the various systems in the woven fabric will be fully analyzed and described.

133. *One-and-One and Two-and-Two Colourings.* — These are the most elementary arrangements of shades. They give different effects, according to the weave in which they are developed. The one-and-one system is applied chiefly to plain and twilled weaves, in which it constitutes two styles of patterns very extensively produced in ordinary fancies. First, in the plain make, it forms the hairline stripe sketched in Fig. 5c; and

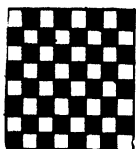


FIG. 60.

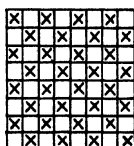


FIG. 60A.

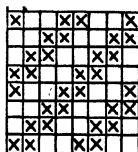


FIG. 61.

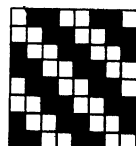


FIG. 61A.

in the cassimere twill, the step-diagonal effect sketched in Fig. 5f. Both are useful textural styles. In cottons, silks, and fancy woollens and worsteds, this order of threads can be made to produce patterns of some intricacy of composition by simply employing in one instance the two plain makes given in Figs. 60 and 60A, and in the other instance the two twills given in Figs. 61 and 61A. Should the plain weaves be combined, say, in such a manner as to make a stripe, and this design woven in the one-and-one system of colouring, the woven result would consist of a band of lines of the respective colours running longitudinally in the fabric, and of a band of transverse lines of the same shades. This is a principle which is capable of being utilized in the construction of elaborately figured designs.

When the weaves supplied in Figs. 61 and 61A are combined, and the resultant design woven in this order of shades, in such sections of the fabric as Fig. 61A occurs, the pattern produced consists of small step effects twilling to the right, but in the

sections composed of Fig. 61, of similar effects twilling to the left; hence, by combining these in the form of stripes, checks, or figures, woven patterns are obtainable diversified in aspect and arrangement.

Next, as to the two-and-two system (Class A, Scheme II., of Simple Colourings) of combining shades. This is another plan of grouping colours for certain elementary crossings. Its effects in the  $\frac{2}{2}$  twill and the mat or celtic are typical of the general style of pattern obtainable.

The results produced in the twill are those in Figs. 62, 62A, and 62B. The different effects are due to the employment of distinct wefts. Thus, in Fig. 62 the weft is grey, in Fig. 62A white, and in Fig. 62B the same as the warp, or two picks of grey and two picks of white. When the grey weft is used, a

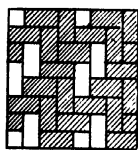


FIG. 62.

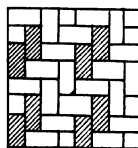


FIG. 62A.

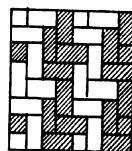


FIG. 62B.

stripe of grey adjoining an intermittent stripe of white is obtained; when white forms the weft, a small line of white adjoins a broken line of grey and white; but when a corresponding method of wefting is adopted as warping, a small broken check effect is acquired.

Changing the weave to hopsack or mat alters the patterns resultant. If the weft be black in this two-and-two colouring, and the weave four-end celtic, a style is constructed similar to that given in Fig. 63, or a pattern with a black ground on which squares of solid white are regularly distributed at uniform distances apart. Substituting white for the black weft, a texture with a white foundation and a black square spot, just the reverse of Fig. 63, is produced; whereas if the weft is the same as the warp, a style composed of solid lines of black and white, or a pattern of a hairline description, results.

These examples clearly set forth the principles of weaving in



## COLOUR IN WOVEN DESIGN.

relation to methods of colouring. Here the same order of threads—though extremely simple—in two different crossings of an elementary structure, forms quite distinct effects. In the cassimere twill more intermingled, and hence less severe patterns, are formed than in the mat or hopsack. They consist of small indefinite stripes and of a minute and irregular check. But in the mat, the same warp colouring gives a well-defined check composition, even when the wefts are all one colour, and instead of a broken check in the fabric when the weft is similar to the warp, as in the twill, a stripe of a decided arrangement is got.

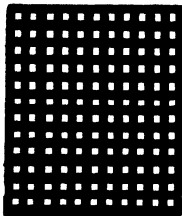


FIG. 63.

134. *Figured Styles in Common Weaves in One-and-One Colouring.*—The principles of woven effect, just elucidated, whereby a combination of plain or twilled weaves may, in the simplest arrangement of colours, be made to produce in the texture two dissimilar patterns, may be utilized in the development of figured designs. Usually these figured fabrics necessitate the adoption of various schemes of weaving and colouring in their manufacture; whereas in this type of design there is no elaboration either of weave or colour. These are particulars of construction peculiar to patterns acquired on this system.

A feature of designs of this class consists in the uniform appearance and sound wearing qualities they impart to the woven fabric. Some kinds of figured textiles are more or less loose on the surface and in structure, owing to the diversity of weave floats requisite to develop the objects or figures composing the designs. No arrangement of this sort, involving intricacy of cloth structure, is needed in gaining patterns by this scheme of weaving. The fabrics, though in some instances elaborately figured, are plain or twill throughout, according to the makes employed—hence the textures are even, firm, and neat in both appearance and construction. Effects of this order are more subdued in tone and possess a mellower aspect than figured styles due to combining various principles of weaving and colouring.

Reference to Figs. 64 and 65 will indicate, first, how the

designs are constructed; and, second, how the textural results are acquired. Fig. 64 is a small spotted design composed of two plain makes. In constructing these designs, the form of the figuring is primarily sketched out on point paper, and the weaves subsequently added. When the two makes are in contact, there must not be more than a float of three. Having worked out the design on point paper, the next matter to be arranged is the development of the ground sections in vertical, and the figured parts in transverse lines of colour, as in Fig. 65, which is

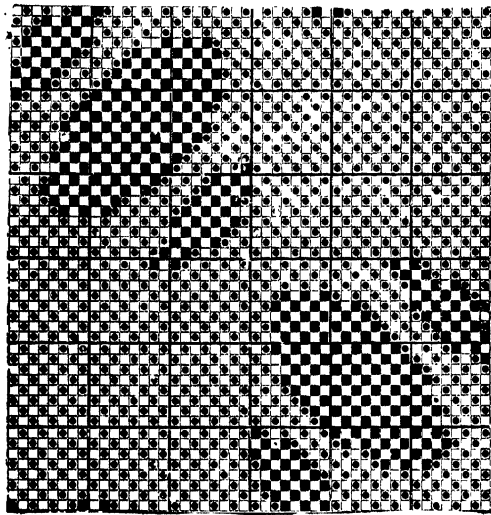


FIG. 64.

a sketch of the textural effect produced by this design. In all designs constructed on this base, it is a rule that the fancy shades in the warp and weft shall, in conjunction, be arranged to form the striped effects described. When the design given in Fig. 64 is warped and woven 1 thread black and 1 thread white, these two shades form stripes lengthways of the piece in the ground portion of the fabric, for the black picks cover the black threads *only*, and the white picks the white threads *only*, while the small figures are developed in short transverse stripes; because, in such sections, the weave in the design causes the black picks

## COLOUR IN WOVEN DESIGN.

to float over the white threads and the white picks to float over the black threads.

Now consider the effect of the same order of shades in the design composed of cassimere twills given on Plate XXI. This style illustrates the process by which the sketch furnished in Fig. 66 is transferred on to point paper and prepared for the loom. Designs for these fabrics are worked out on the same system as the preceding example. A comparison of Fig. 65 with Fig. 66 brings out several points of dissimilarity. These do not

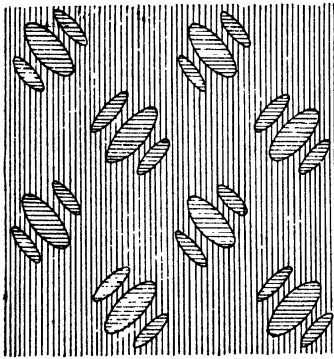


Fig. 65.

arise from any variation of the plan of colouring, but of the plan of interlacing the threads in constructing the fabric. The vertical and transverse lines of Fig. 65 are substituted by neat diagonal effects, and a pattern of more diversified outline and arrangement obtained. It has been pointed out that the thread-and-thread scheme of shades yields, in the cassimere twill, the two effects seen in Fig. 66. When the weave

runs to the right, the black and white diagonal effect runs to the left, and *vice versa*; so that in preparing the designs for the loom it has, in the first place, to be decided whether the ground or the figured sections shall be developed in the minute diagonals of shades moving to the right. Generally, it will be found that this effect is most suitable for the ground.

135. *Utility of the One-and One Principle in Figured Textiles.*—The scheme of textile colouring and designing analyzed in the previous paragraph is applicable to a large diversity of goods, including cotton, silk, worsted, and woollen fabrics. Styles for dress stuffs and mantlings may be produced in this manner. Cotton yarns in these designs produce very effective patterns. The compact structure of these threads develops both series of effects with a clearness and prominence that are absent from cloths composed of woollen materials. Whether the designs are

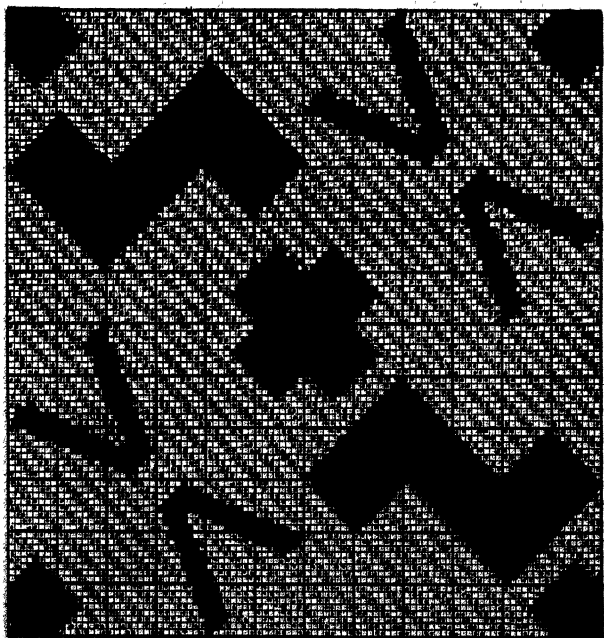


Plate XXI  
FIGURING IN SIMPLE TWILLS





employed in one set of yarns or the other, schemes of colouring such as the following may be employed:—

## I.

- 1 thread of dark brown  
(Shade 1, Plate IV.).  
1 thread of medium brown  
(Shade 3, Plate IV.).

## II.

- 1 thread of dark grey.  
1 „ light „

## III.

- 1 thread of medium grey.  
1 „ white.

## IV.

- 1 thread of lilac (Tint 17,  
Plate VI.).  
1 thread of white.

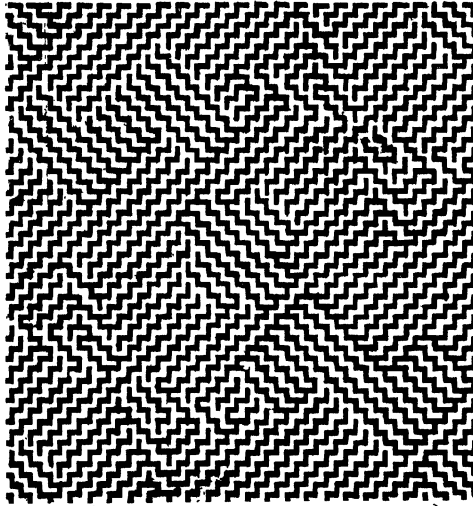


FIG. 66.

Colours slightly contrasting in hue, or merely in shade, may be used in worsted yarns; but in woollens, where the effect is not so clear or pronounced, owing to the structure of the yarn, more contrast of colouring is requisite to emphasize the figuring. Woollen fabrics coloured on this principle may be either "clear" finished or covered with fibre. It depends entirely on the type of fabric produced. If a dress texture, the best results may be obtained by developing the effect of the colours as much as

possible in the finishing processes; but if a mantling, a soft, fibrous surface enhances the mellowness and attractiveness of the patterns formed.

Of course the methods of figuring obtained by this thread-and-thread colouring are combined with other schemes of colours

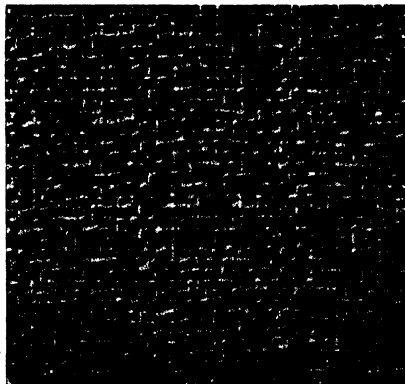


FIG. 67.

in making more elaborate patterns. For example, a band of figuring, such as is given in Fig. 66, may be arranged to adjoin a bold stripe of entirely distinct colouring, and thus a pattern produced containing much diversity of composition.

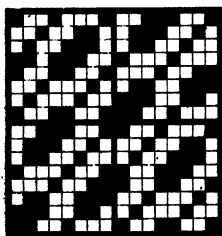


FIG. 67A.

Pattern is acquired in these and similar designs economically in the loom. No complication, either of weave or of colour, arises in their origination. By the employment of two shades and one weave—used in such a manner as to yield two varieties of style—any form of figuring is on this system producible.

136. *One - and - One and Two - and - Two Colourings in Fancy Weaves.* —

Some applications of this scheme of colouring to other weaves than the plain and twill are shown in Figs. 67, 68, 69, the plans being Figs. 67A, 68A, and 69A. The only alteration in the colouring is the use, as seen, of fancy thick yarns for striping or checking. The contrast in the weaves should be noticed, and also

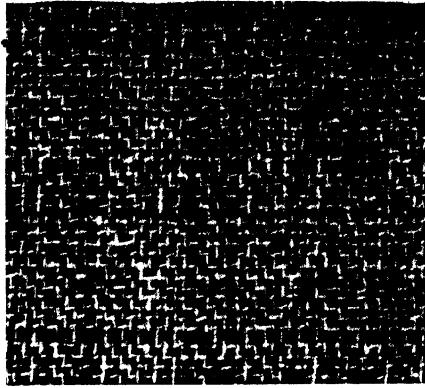


FIG. 68.

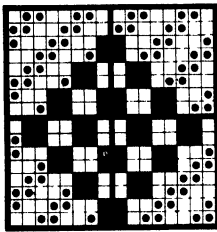


FIG. 68A.

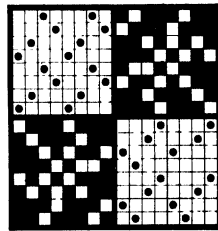


FIG. 69A.

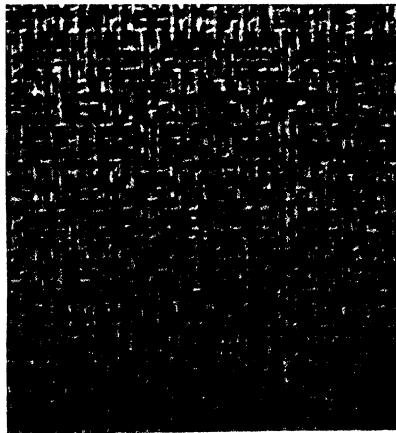


FIG. 69.



in the woven patterns. The weaves comprise (Fig. 67A) a fancy twill composed of  $\frac{3}{1}$  and  $\frac{1}{3}$  twills; Fig. 68A, twill and mat; and Fig. 69A, check in broken  $\frac{3}{1}$  and  $\frac{1}{3}$  twills. The line characteristic is noticeable in Figs. 67 and 69, being more pronounced in the latter. Fig. 68 is the most regular in style, due to the weave being composed of twill and mat.

Figured styles in two-and-two colouring are producible in the designs made on the principles given in Paragraphs 134 and 135, and also in other simple weaves similarly combined. One

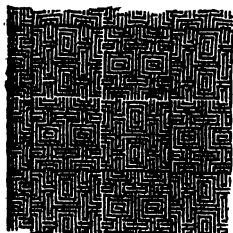


FIG. 70.

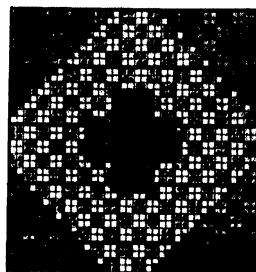


FIG. 70A.

example (Fig. 70) may be taken, woven in the  $\frac{2}{2}$  mat, the sectional design being given in Fig. 70A. The order of colouring in both warp and weft is:—

Black	.	.	.	2	} For 36.
White	.	.	.	2	
White	.	.	.	2	} For 36.
Black	.	.	.	2	

By the change in the positions of the colouring, the key pattern is inverted and made more diversified in character.

137. *Three-and-Three Colouring.*—This method of grouping shades of warp and weft (Class A, Scheme III.) is employed in the six-end twill and its derivatives, also in twelve-shaft and other weaves.

An example of the effects in the  $\frac{3}{3}$  twill in the fabric, due to three-and-three warping and various weftings practised, is

sketched in Figs. 71, 71A, and 71B. The first of these illustrations has a grey weft; Fig. 71A is woven with white, and Fig. 71B with three picks of grey and three picks of white.

138. *Four-and-Four Arrangement.* — Twill, hopsack, and other common weaves are used in producing styles in this order of colours, which is supplied in Scheme IV. of Class A of the

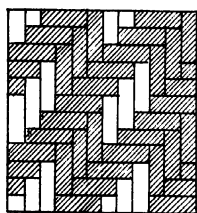


FIG. 71.

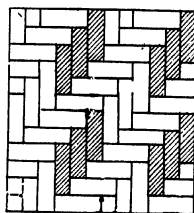


FIG. 71A.

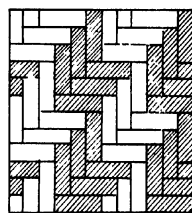


FIG. 71B.

Regular Simple Colourings. Black and white shepherd plaids are made on this base, a useful form and size of check resulting from its employment. Some of the effects got in the cassimere twill by warping four threads of grey and four threads of white,

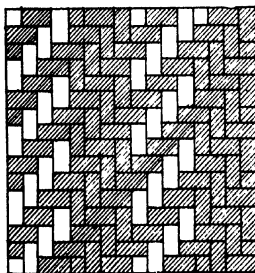


FIG. 72.

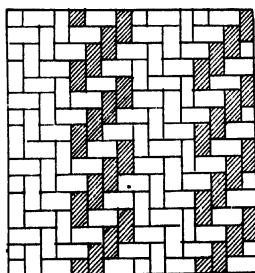


FIG. 72A.

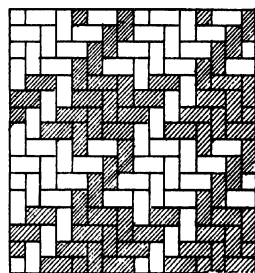


FIG. 72B.

and wefting with white and grey, and with the same order of shades as in the warp, are sketched in Figs. 72, 72A, 72B. The check style here is particularly neat. It is produced in a variety of colours for almost all kinds of fabrics. When the four-end mat weave is used, a species of star check is formed, as seen in Fig. 73. A considerable range of patterns ensues from adopting this order of colours and combining the cassimere and mat

weaves in the construction of stripe, check, and diagonal designs. Thus, supposing the last type of weave-combination were employed, then in such parts of the diagonal where the twill occurred, the shepherd plaid effect would result, but the hopsack sections would yield the star check style, so that diagonal bands of these respective patterns, regularly alternating, would extend across the fabric.

139. *Four-and-Four Method applied to Fancy Weaves.*—There are various patterns obtained in this order of threads by

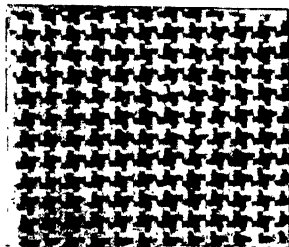


FIG. 73.

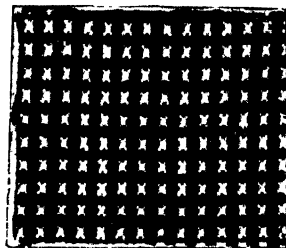


FIG. 74.

using other weaves than the twill or mat. As an illustration in these effects, Fig. 74, which has been produced in the weave given in Fig. 74A, may be examined. It is a small spotted design; the minute crosses of white, surrounded by rectangles of black, are determined in shape and dimensions by the arrangement of warp and weft flushes composing the crossing. The weft yarn of this pattern is all black. Comparing this style with that sketched in Fig. 72, which is composed of the same order of threads, it will be observed that any modification of weave alters the pattern resultant.

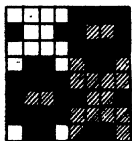


FIG. 74A.

In the weave furnished in Fig. 74A, the white threads only show on the face of the texture where the blank spaces occur; whereas, in the cassimere twill employed in the construction of the sample shown in Fig. 72B, the white warp threads float on the face of the fabric on the same system as the black picks. The pattern given in Fig. 74 indicates how, by resorting to novel schemes of weaving, the simplest methods of colouring may be made to produce distinct patterns.

Employment of other weaves than the twill and mat give equally satisfactory results. Such makes are, of course, multiplied in proportion to the ingenuity of the designer. The example considered is but a type of the numerous styles obtainable in this four-and-four colouring by having recourse to designs of this type.

140. *Six-and-Six and Eight-and-Eight Schemes*.—These are not given in the plan of Regular Simple orders of shades, being but extensions of Schemes III. and IV.; but they are important in practice, and must be considered as distinct principles of grouping colours. They are mainly employed when well-pronounced patterns are required in fine yarns, in which instances they yield far more effective styles than the schemes of shades from which they are derived. In both worsted and cotton dress textures and tweed mantlings, they are largely used.

Both systems are illustrated. The six-and-six plan, and the styles it gives in the six-end twill, are furnished in Figs. 75, 75A, and 75B. The same methods of weft colouring have been practised as in other sketches, showing the changes resulting from varying the weft from light to dark, and from having it exactly like the warp. Fig. 76 has been produced in the eight-shaft twill, and is composed of 8 threads of black and 8 threads of white in both warp and weft. Should such shades as the following be used in the six-end twill, more toned patterns result than those supplied in the illustrations:—

I.	II.
6 threads of slate. 6     "     slate and white twist.	6 threads of light fawn. 6     "     light fawn and white twist.
III.	IV.
6 threads of blue. 6     "     brown.	6 threads of No. 2 mixture, Plate XIII. 6 threads of No. 8 mixture, Plate XIII.

The I. and II. Schemes are for light textures. They illustrate an important method of combining shades, inasmuch as the same shade occurs in both the first and second group of six

threads in each example. Thus, in Scheme I. the second group of ends consists of slate and white twist—the slate being exactly of the same hue as that used in the first six threads. This arrangement gives neatly-toned patterns, and is suited for Simple Colourings in which the respective shades are combined in these qualities. The third group of shades is for

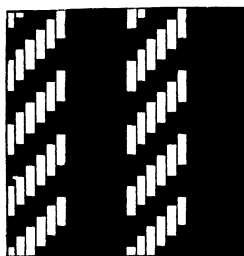


FIG. 75.

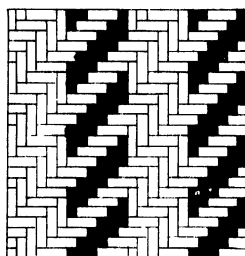


FIG. 75A.

a dark pattern. Here the contrast should not be strong; the mellowed the better. It only requires to be sufficiently pronounced to develop the outlines of the checkings and the effects due to the plan of interlacing the threads. A mixture-

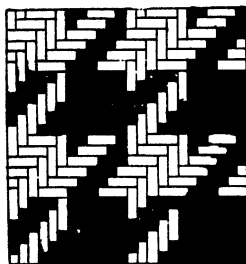


FIG. 75B.

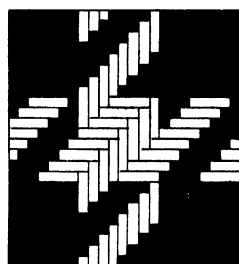


FIG. 76.

yarn example is also given in the fourth scheme of shades. Yarns of this class are useful in the manufacture of both worsteds and tweeds. The black and white shades which have been used in these illustrations—75, 75A, 75B, and 76—bring out the character of the pattern due to the structure of the weave.

141. *Six-and-Six Colourings in Various Crossings.*—Two

examples may be examined in which weave has been advantageously employed in these schemes of colouring. The first, Fig. 77, is a species of check, the patches of the two shades being differently shaped from what they are in Fig. 75B, which is a composition of the same order of shades. This arises from the structure of the weave employed. It is given in Fig. 77A,

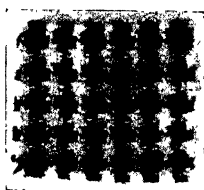


FIG. 77.

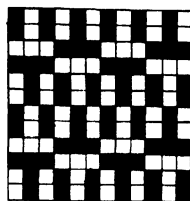


FIG. 77A.

and is a combination of warp and weft cords. The *warp* cord causes the spaces of black and white to practically run into each other in the direction of the warp, and the *weft* cord makes them continuous in the line of the weft.

The next illustration, Fig. 78, is commonly termed the star

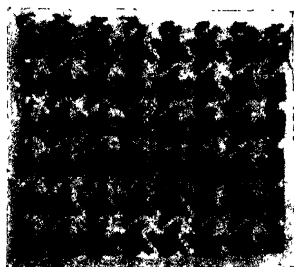


FIG. 78.

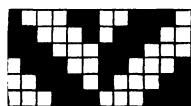


FIG. 78A.

check. It somewhat resembles Fig. 73, but the effects are more prominent and better developed. The weave used in this case is the six-end twill angled, Fig. 78A. In making the pattern, the first six picks should be black, otherwise they would not meet the interlacings in the weave on the system requisite to give this effect.

142. *Three-Odd-Thread Arrangement*.—For the plain weave,

prunelle, and six-end twills, this is one of the useful schemes of colouring. In the plain it forms, when woven with the same order of weft as warp threads, the neat style sketched in Fig. 79. When the shades are black, grey, and white, as in Scheme I,—Class B, of the Regular Simple Colourings,—small vertical and transverse lines of these shades are formed, meeting each other at right angles. Thus, in Fig. 79, the vertical lines of black oppose the transverse lines of black, and the same arrangement obtains in regard to the grey and white lines.

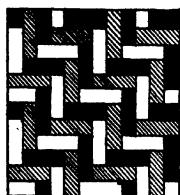


FIG. 79.

Check patterns are producible in this scheme of shades by colouring as follows:—

For	{	1 thread of russet (No. 7, Plate III.).
18 threads.		1 „ citron (No. 8, Plate III.).
		1 „ olive (No. 9, Plate III.).
For	{	1 thread of russet.
18 threads.		1 „ citron.
		1 „ blue.

In the first eighteen threads, the effects formed are of russet, citron, and olive; but in the last eighteen, blue takes the place of the olive, so that when the style is woven with the same series of weft as warp colourings, it makes a mellow check design.

Another method of adding to the utility of this form of pattern consists in introducing into its composition an over-check of fancy shades, which may be obtained thus:—

For	{	1 thread of black.
19 threads.		1 „ brown.
		1 „ black and white twist.
		1 thread of black and blue twist.
		1 „ black and scarlet twist.

There results from this method of grouping shades, a pattern consisting of a rectangular space of nineteen ends and picks of small effects, similar to those seen in Fig. 79, but consisting

of black, brown, and black-and-white twist, instead of black, grey, and white. In the prunelle twill, this colouring produces hairline patterns in three shades. Other stripe and check designs result from combining the warp and weft weaves, and developing in the same colouring.

The effects obtained from using this colouring in the six-end twill are more diversified in character than those producible in the plain make. They are of three distinct styles. The style of pattern now acquired depends on the method in which the respective shades meet each other in the weave.

The several effects obtained, when the  $\frac{3}{3}$  twill is used, are shown in Fig. 80. This has been developed in the weave

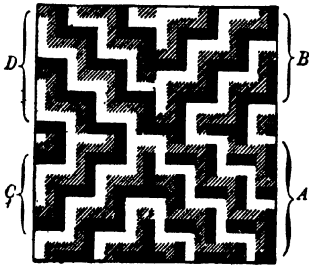


FIG. 80.

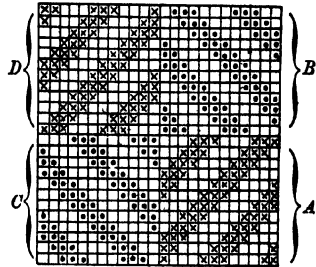


FIG. 80A.

given in Fig. 80A, which is a small check design composed of six-end twill, running in two directions. Let the sections of the woven pattern acquired in Fig. 80 be analyzed separately. It must be understood that the order of shades is the same throughout, namely, that in Scheme I. of Class B of the Regular Simple Colourings. Hence the diversification of style here noticed is a resultant of weave and not of colour combinations. The different effects acquired in Sections A, B, and D, show that makes of various constructions have been employed. A distinct style obtains, for instance, in Part A from Part B. In the former, lines of black are set at right angles to other lines of this shade, while the grey and white yarns form diagonals; but in B all the three shades run diagonally. Section C is practically the same as B, while D



is also similar, only twilling to the left. The parts lettered *A*, *B*, *C*, and *D* in the design, Fig. 80A, correspond to those just described. One other effect may be got in the six-end twill besides those considered in this order of threads, namely, that in which two diagonals, grey and white, twill to the left, or the opposite to what they do in *A*, and small transverse lines of black be set across similar vertical lines. If the positions of the shades were altered, the grey or the white yarns might be made to form the disconnected spots.

A further principle of colouring suggested by this illustration is, that the same plan of shades and method of weaving are capable of yielding different woven results according to

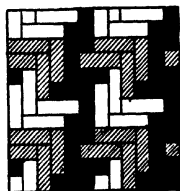


FIG. 81.

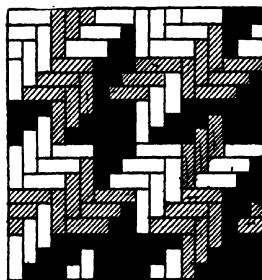


FIG. 82.

the system on which they are combined. Thus, as has just been indicated, without modifying the scheme of colours, the check design in the six-shaft twill gives the effects sketched in Fig. 80. Parts *A* and *D* are formed by one weave running to the right, yet how different they are in character! To what is the difference due? The design shows that the black threads and picks do not meet each other in the same way, for while in Part *A* of Fig. 80A the first pick is two threads down, three up, three down, three up, and one down; in Part *D* it is three up and three down, so that in reality the first pick in *A* corresponds to the fifth pick in *D*. Still, though the order of the threads is the same in both sections, the methods on which the colours are crossed in the respective parts of the texture are dissimilar, hence corresponding results cannot possibly ensue. This difference of effect, arising from

commencing colouring on certain threads and picks of the weave, increases the variety of styles obtainable in the same order of threads and principle of intertexture.

143. *Various Three-shade Patterns.*—Amongst other Simple orders of colouring composed of three shades are those given in Schemes II., III., and IV. of Class B. Each system may be developed in the six-end twill—the last system, which may be termed the three-4's, also produces standards in four-shaft weaves. Only two of these principles are illustrated, namely, the three-2's and the three-3's. It will be evident from the sketches, Figs. 81 and 82, that these patterns belong to a useful class of effects. Fig. 81 is a neat form of intermingled check. Such compounds of shades as the following may be applied:—

## I.

- 3 threads of citron (No. 9, Plate III.).
- 3     „     olive (No. 1, Plate III.).
- 3     „     russet (No. 7, Plate III.).

## II.

- 3 threads of dark blue (No. 7, Plate IV.).
- 3     „     dark olive (No. 13, Plate IV.).
- 3     „     dark brown (No. 1, Plate IV.).

## III.

- 3 threads of light olive (No. 9, Plate VI.).
- 3     „     lilac (No. 17, Plate VI.).
- 3     „     fawn (No. 10, Plate VI.).

The I. and III. of these colourings are suitable for dress fabrics, but the II. is adapted for tweed suitings. This form of pattern should also be developed in mixture and twist yarns in woollen, worsted, and cotton materials.

As a result of employing this scheme of shades, three sets of checks, each formed within the other, are obtained in the fabric. By examining Fig. 81, it will be observed there is first the check of black; second, the check of grey; and third, the check of white. The character of the style due to the weave is apparent in this illustration. There is also perfect

balance of shades. This feature, which mainly results from the twill employed in the construction of the pattern, contributes to the general character of the style. Still, it will be noticed that the manner in which the black threads interlace produces a different check from that resulting from the grey or white yarns.

Fig. 82 gives a more irregular style than Fig. 81, on account of the weave being repeated three times, and the order of the shades twice, before one complete pattern is acquired. This arises from there being nine threads in the plan of shades—3 of black, 3 of grey, and 3 of white—and six threads in the weave. The pattern sketched in Fig. 82 in one particular

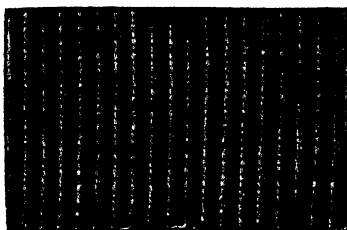


Fig. 83.

resembles the preceding style, for the shades combined form three broken checks, but in other characteristics it is quite different. The element of black is exactly proportionate to that of grey or white, and each shade constitutes a well-defined series of minute effects, which, by

repetition, bring out the check character of the style. It is a base that is improved by diversity of colouring. In combination with Fig. 81, wefted either three-2's or three-3's, it yields stripe and check designs of a broad character.

144. *Simple Colourings composed of Four Shades.*—Each of the four arrangements in Class C of Simple Colourings is illustrated. Scheme I. is given in Fig. 83. It forms a hairline stripe of four colours if produced in the swansdown weave, when the order of the wefting is 1 pick black, 1 pick dark grey, 1 pick white, and 1 pick medium grey. This style is applied to fancy woollens, and also to worsteds. It is a standard colour-base for trouserings and fabrics in which a fine line pattern is required. The same arrangement of shades in the plain weave makes a mixture effect, and in the common twill the colourings form a minute broken check.

Fig. 84 results from the II. Scheme of Colouring given in

Class C. The weave is cassimere twill, but the celtic or mat, and other weaves of a regular construction on four and eight shafts, are also used. Here are four more or less disconnected checkings of colours forming an intermingled pattern, choice in outline and soft in tone.

A more pronounced style is got when the quantities of the several shades are increased, and a weave selected of an open structure. These points are brought out in Fig. 85, in which the same arrangement of shades obtains as in Fig. 84, only the quantity of each colour is increased one-third, and the six-shaft twill substituted for the four-shaft twill. Broader effects are therefore the result. Were this sketch repeated, to show the

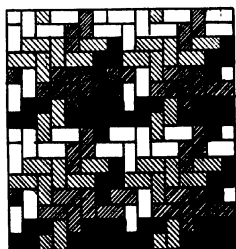


FIG. 84.

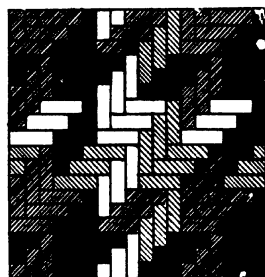


FIG. 85.

outline of the pattern more clearly, it would be observable that the black, dark grey, medium grey, and white shades all form checkings, which, in the fabric, are quite distinct from each other. As the order of shades here contains twelve threads, the six-shaft twill is one of the best weaves that can be employed for regularly and equally distributing the shades.

Eight-shaft makes being repeated three times before they meet the plan of colours, give more irregular and mingled effects.

The last example in Simple Colourings obtained by combining four shades is given in Fig. 86. It has been produced in the Mayo weave, in Fig. 86A. In common twills of more uniform interlacings, it gives a pattern of more decided markings. The Mayo weave has broken up the groups of fours into which the

colours are divided. As a consequence, the resultant style is characterized by softness and intermingled colouring. The weave effect is an important feature. Either sets of hues of different colours of the same depth, or sets of shades in one colour, may be employed in this scheme.

All the examples described in Regular Simple Colourings are of a typical character, and in practice are diversified in colouring and in weave.

145. *Irregular Simple Colourings*.—These are patterns in which the quantities of the different shades used, or the plans of colouring as to succession of colours, are not uniform. They are not so numerous as the “Regular Colourings” already considered,

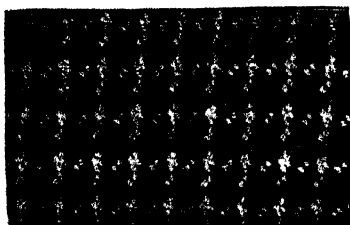


FIG. 86.

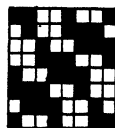


FIG. 86A.

but they are important in pattern designing. The principal of these combinations are furnished in the Table below :—

TABLE X.

## IRREGULAR SIMPLE COLOURINGS.

## CLASS A.—COMPOSED OF TWO SHADES.

*I. Scheme.*

2 threads of black.  
1 thread of white.

*II. Scheme.*

4 threads of black.  
1 thread of white.

*III. Scheme.*

4 threads of black.  
2                white.

*IV. Scheme.*

4 threads of black.  
2                white.  
2                black.  
2                white.

TABLE X.—*continued.*

## CLASS B.—COMPOSED OF THREE SHADES.

<i>I. Scheme.</i>	<i>II. Scheme.</i>
2 threads of black.	3 threads of black.
2     "     grey.	2     "     grey.
1 thread of white.	1 thread of white.
<i>III. Scheme.</i>	<i>IV. Scheme.</i>
6 threads of black.	6 threads of white.
4     "     medium grey.	2     "     grey.
2     "     white.	2     "     black.
	2     "     grey.

## CLASS C.—COMPOSED OF FOUR SHADES.

<i>I. Scheme.</i>	<i>II. Scheme.</i>
3 threads of black.	4 threads of black.
2     "     dark grey.	3     "     dark grey.
2     "     medium grey.	3     "     medium grey.
1 thread of white.	2     "     white.
<i>III. Scheme.</i>	<i>IV. Scheme.</i>
4 threads of black.	4 threads of black.
2     "     medium grey.	2     "     medium grey.
4     "     light grey.	2     "     light grey.
2     "     white.	4     "     white.
	2     "     light grey.
	2     "     medium grey.

146. *Irregular Simple Patterns of Two Shades.*—In this class of colouring are found some useful bases for fancy textures composed of simple twills and other elementary crossings. They may be considered in the order named in the Table. The first scheme is most generally used in the prunelle twill, in which weave it gives lines lengthways or across the texture, according to whether the make is warp or weft flushed. These two twills combined in figured designs, and this order of colouring adopted, produce a style of pattern resembling that got by blending two plain makes, only one line of colour is twice the thickness of the other.

The II. Scheme finds application to five-shaft weaves. Thus, in twill, Fig. 87A, it makes the neat check style seen in Fig. 87. The same scheme is applied to cottons and fancy woollens. Some effective patterns ensue from colouring—

For { 4 threads of black.  
25 threads. { 1 thread of white.  
For { 4 threads of white.  
25 threads. { 1 thread of black.

The form of the pattern resultant from this arrangement comprises a series of effects similar to Fig. 87, and then a series of effects with a white ground and black spotting.

The extent to which one thread and a slight change in the weave may alter the nature of a woven pattern is illustrated by

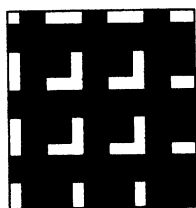


FIG. 87.

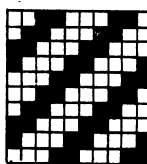


FIG. 87A.



FIG. 87B.

Fig. 87B, obtained in the four-end celtic and the III. Scheme of shades in Class A. The weave and the colours are combined on such a principle, that the shade used in the smallest quantity forms short vertical and transverse lines on the surface of the texture. This, like the preceding example, is an order of colouring that is frequently varied by transposing the shades thus:—

For { 4 threads of black.  
24 threads. { 2 „ white.  
For { 4 threads of white.  
24 threads. { 2 „ black.

Providing the weft is the same as the warp, a square is first formed in which the lines or spots are white, and arranged on a black ground, and then a check of black lines on a white ground. When the shades do not form strong contrasts, this base is

capable of being utilized in the production of a large variety of fancy fabrics.

A more irregular effect, Fig. 88, results from employing Scheme IV., than either Schemes II. or III. The weave, Fig. 87A, produces the mingled cast of the pattern. Shades may be employed here that give well-emphasized contrasts.

There are several other forms of these colourings, such as the following:—

(a)	(b)	(c)
5 threads of black.	6 threads of black.	8 threads of black.
2     „     white.	2     „     white.	3     „     white.
		2     „     black.
		3     „     white.

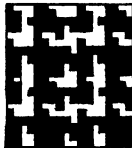


FIG. 88.

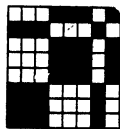


FIG. 89A.

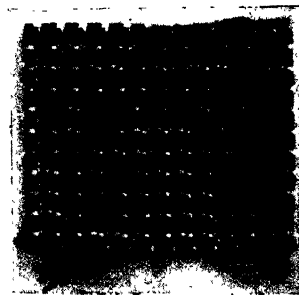


FIG. 89.

The first of these is applicable to seven- and fourteen-shaft weaves, in which it may be made to produce some characteristic effects. The second of these additional irregular two-shade colourings is mostly employed in eight-end makes of special construction. Two patterns in which it has been used are sketched in Figs. 89 and 90. It is the structure of the respective weaves that is the cause of one pattern—Fig. 89—being a minute check of a clear outline; and of the other pattern—Fig. 90—being a bird's-eye spot. In Fig. 89, the weave is a fancy mat, Fig. 89A. The white threads in both warp and weft fall on the 7th and 8th threads and picks in the weave. To these threads and picks, the check character of the pattern is due. They cause the black



yarns to be grouped together in the form of a minute irregular rectangle, and the white yarns to give the skeleton-check effect. In Fig. 90A, the same threads and picks again determine the specific effect of the pattern. They so control the grouping of



FIG. 90.

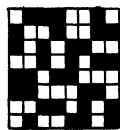


FIG. 90A.

the yarns that the white threads produce the small spot or star. These illustrations demonstrate the principle of originating plans of weaving, which will change the pattern produced by a given set of colours in such manner as to compose distinct styles.

The effect of the third arrangement given above is to form the pattern seen in Fig. 91. It is a base that frequently finds an important place in tweeds, flannels, dresses, and worsted suitings.



FIG. 91.

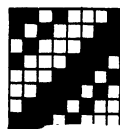


FIG. 91A.



FIG. 92.

It is a neatly-marked check. The weave employed in its construction is Fig. 91A. This scheme is developed in light, medium, and dark shades, and in self, compound, and mixture yarns. Considering that only two shades are used in its construction, it is a pattern having diversity of outline.

.147. *Irregular Simplex, composed of Three Shades.*—Brief descriptions need only be given of these. A small check is

obtainable by the first of these schemes. It is best adapted for weaves occupying five threads. The weave employed in making this pattern—Fig. 92—is Fig. 87A.

The II. Scheme is workable in the six-end twill, in which it yields an ordinary suiting style (Fig. 93). The shades used in

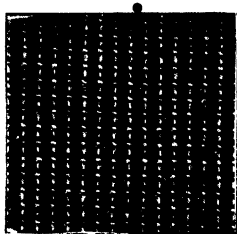


FIG. 93.

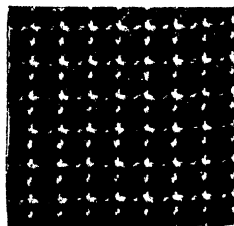


FIG. 94.

the largest proportions in this pattern should be the most subdued in tone, while the colour for the single thread should be the brightest. This arrangement has been adhered to in the illustration.

Schemes III. and IV. may be analyzed together. The former,

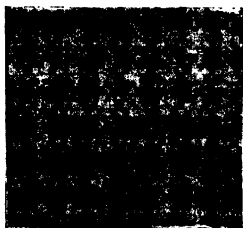


FIG. 95.

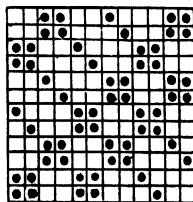


FIG. 96.

Fig. 94, has been developed in the six-end twill, and the latter, Fig. 95, in the mat or celtic. They are two typical patterns. The latter pattern appears to combine both check and figured effects, the small detached lines of black producing the figured appearance, and the grey shade, in combination with the black and white, yielding the toned check characteristic. It is applicable to all classes of simple fancies. It does not possess that, distinct check cast which is so apparent in Fig. 94. This style

is really constructed on a similar principle to Fig. 93, for the respective shades gradually decrease in quantity from the beginning to the end of the pattern. All such arrangements admit of two methods of colouring. In the first place, the darkest shade may be made the principal factor, and in the second place, the

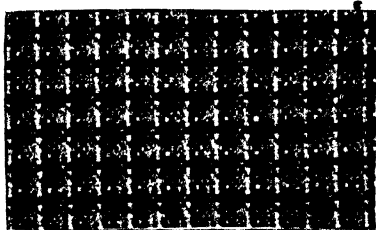


FIG. 97.

lightest shade. The intermediate colour—in this instance grey—is invariably placed in the centre in this style of colouring.

148. "*Irregulars*" composed of *Four Shades*.—The first of these schemes gives an effect somewhat similar to that which results from Fig. 93, only here the cassimere twill may be employed, and probably a neater pattern acquired. In certain weaves, such as Fig. 96, the Second Scheme, Class C, produces an

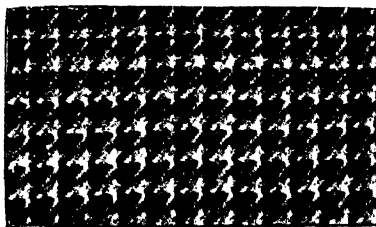


FIG. 98.

excellent type of suiting. It is illustrated in Fig. 97. If clearer effects are needed, common twills should be used, such as the six-end weave, which forms the pattern in Fig. 98. The III. Scheme yields in the Mayo a very effective pattern, as is seen in Fig. 99. Here the black yarns produce a broken line, while the other colours constitute intermingled checkings. This is a base, capable of being employed in the manufacture of various

classes of fancy textures. Scheme IV., Fig. 100, is a neat method of grouping shades for fancy checks. The pattern sketched has been produced in the sixteen-shaft diagonal (Fig. 100A), but it might also be worked in common twill and mat weaves. Such a diagonal adds, however, to the attractiveness of the intermixture

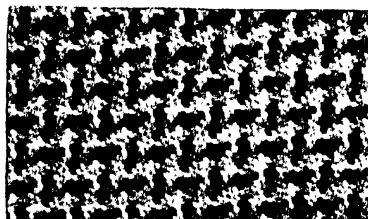


FIG. 99.

of shades. The characteristics of this example are due to the system on which the threads of warp and weft interlace. The pattern is a species of shaded check. From the tinted white to the

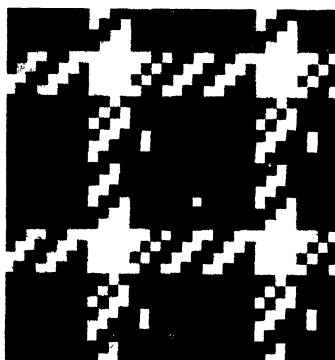


FIG. 100.

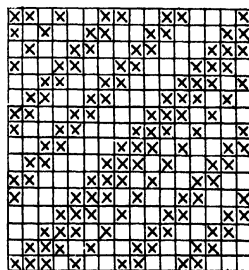


FIG. 100A.

black there is a graduated shade of greys, and in the following sets of colourings the same mellow toning would be observed.

## I.

4 threads of black.  
 2   "   dark brown.  
 2   "   olive   "  
 4   "   light   "  
 2   "   olive   "  
 2   "   dark   "

## II.

4 threads of black.  
 2   "   dark grey.  
 2   "   light   "  
 4   "   white.  
 2   "   light grey.  
 2   "   dark   "

## III.

4	threads of dark blue and dark grey twist.
2	" " " " medium grey twist.
2	" " " " light grey twist.
4	" " " " white twist.
2	" " " " light grey twist.
2	" " " " medium grey twist.

This colour-base may be applied to cotton textures and light fabrics, when the colourings should be considerably brighter than those enumerated. For variety of effect, it is one of the most important colourings included in the ordinary series of irregular elementary styles.

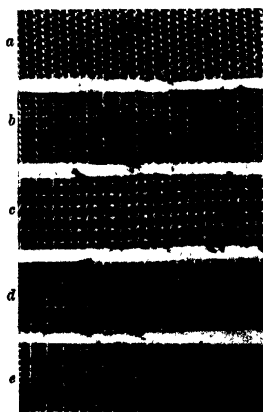


FIG. 101.

149. *Cross-Weftings*.—This term is applied to weft colouring which does not correspond with the warp colouring as to order of shades. All the Simple, and many of the Compound special Schemes of Colouring may be cross-wefted. As a result, another form of coloured pattern is obtained

from that due to applying the same order of wefting as warping.

The following scheme (Fig. 101) is typical:—

<i>Warp.</i>	
3 black.	3 white.
<i>Wefts.</i>	
(a) 1 black. 1 white.	Woven in the $\frac{2}{2}$ twill.
(b) 2 black. 2 white.	
(c) 4 black. 4 white.	
(d) 1 black. 1 white.	In the $\frac{3}{3}$ twill
(e) 2 black. 2 white.	
	In the $\frac{2}{2}$ mat.

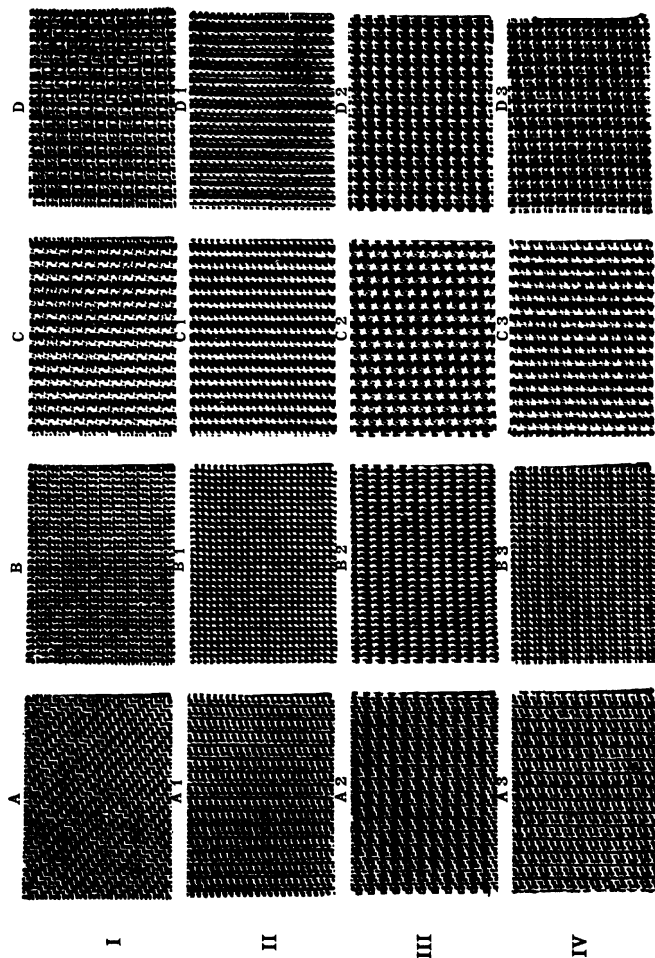
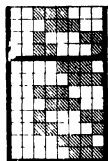


Plate XXII



On Plate XXII., some further examples of the effects of cross-wefting are illustrated. The orders of warping and wefting are as follows:—

<i>Warping.</i>	<i>Wefting.</i>
<i>Series A to A3.</i>	<i>Series I.</i>
2 dark.	Same as warp for
2 light.	Series A to A3.
<i>Series B to B3.</i>	<i>Series II.</i>
3 dark.	Same as warp for
3 light.	Series B to B3.
<i>Series C to C3.</i>	<i>Series III.</i>
6 dark.	Same as warp for
6 light.	Series C to C3.
<i>Series D to D3.</i>	<i>Series IV.</i>
4 dark.	Same as warp for
4 light.	Series D to D3.
2 dark.	
2 light.	

Patterns A, B1, C2, and D3 are woven as warped, but other specimens are cross-wafted. Of the latter, the following are regular styles and correct pattern bases:—A1, A2, B, C, C1, C3, D, D1, and D2. Examples A2, D2, and D3 are striped or lined across, showing that in extreme differences between the warping and wefting, irregular forms of pattern or effect result: *e.g.* A2 warped 2-and-2, and wafted 6-and-6; and D2 and D3 warped 3-and-3, and woven 6-and-6, and 4, 4, 2, 2 respectively.



## CHAPTER IX.

### COMPOUND COLOURINGS.

150. Compounds—151. Compounds composed of Three Types of Elementary Colouring—152. Results of combining Simple Colourings—153. Compounds and Weave Combinations compared—154. Utility of a Practical Knowledge of the Woven Effects of Simple Colourings—155. Compound Patterns subjective to the Nature of the Fabrics Manufactured—156. Types of Compounds—157. Compounds composed of Two Simple Types—158. Patterns composed of Two Types and Three Shades—159. Styles of Four Shades containing Two Simple Types—160. Styles composed of Three Simple Types—161. Irregular Compounds.

150. *Compounds*.—As these are composed of several elementary schemes of colouring, they are generally patterns of some intricacy of composition. With only two shades it is possible to obtain varied effects in this style of woven colouring. When three or more shades are used, and several simple methods of grouping shades practised, though the weave may be of a common twill or mat description, Compound patterns may be quite elaborate in arrangement. The elaborateness of the style resultant is determined by several factors, such as the character of the types, number of the Simple Colourings combined, and the diversity of the shades employed. The simpler the schemes of colours selected, the fewer the elements of the compound, the more ordinary in cast and aspect is the pattern acquired. Still, the commonest groupings of shades, even when combined on the simplest system, form woven styles of considerable richness of composition. One example, Fig. 102, is suggestive of the characteristics of this species of textile colouring. It is the most elementary type of compound, resulting from combining Methods I. and II., supplied in Table IX., and consisting of black and white. But it is a pattern which comprises several styles of minute effects. It is divided into four rectangular spaces, A,

*B*, *C*, and *D*. Each square is formed of a different kind of textural design. Thus, in Section *A*, which is composed of two threads of black and two threads of white in both warp and weft, it will be noticed there are small irregular checkings forming vertical lines; in *B*, where the one-and-one order of warp colouring is crossed by the two-and-two order of wefting, minute figures, or spots of white, separately surrounded with black, occur; in Section *C* the same figures obtain as in *B*, only they are inverted, owing to the warp and weft colourings meeting each other in the reverse way to what they do in *B*; Section *D* consists of small step-twill effects. So there are thus, in this pattern, four textural results so associated as to form a neat check design, which is producible in

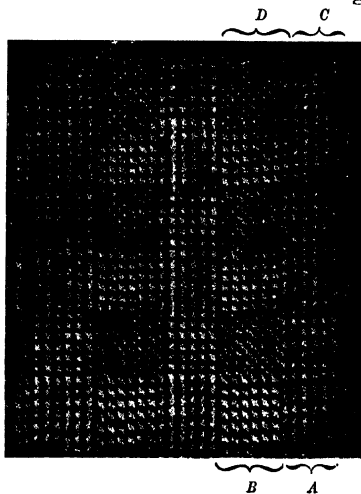


FIG. 102.

woollen, worsted, silk, and cotton yarns. It may be diminished or increased in size, and modified in various ways. For example, Checks *A* and *C* may be double the size of *B* and *D*; or several striped patterns may be acquired by using Sections *C* and *D* together and Sections *A* and *B*—the spaces of each effect being determined by the class of fabric in which the style is produced. For trouserings they must be comparatively small, but for dress textures and mantlings they may be some inches in width. In such shades and tints as are appended, both the original pattern and the modifications named may be developed:—

## I.

For 24	{	1 thread of Shade 2, Pl. IV.
threads.		1        "        "        8,        "
For 24	{	2 threads of Shade 2, Pl. IV.
threads.		2        "        "        8,        "

## II.

For 24 { 1 thread, of Shade 7, Pl. VI.  
 threads. { 1       "       " 13,       "  
 For 24 { 2 threads of Shade 7, Pl. VI.  
 threads. { 2       "       " 13,       "

## III.

For 24 { 1 thread of Tint 4, Pl. IV.  
 threads. { 1       "       " 4,       " VI.  
 For 24 { 2 threads of Tint 4, Pl. IV.  
 threads. { 2       "       " 4,       " VI.

## IV.

For 24 { 1 thread of Tint 10, Pl. VI.  
 threads. { 1       "       " 16,       "  
 For 24 { 2 threads of Tint 10, Pl. VI.  
 threads. { 2       "       " 16,       "

These colourings, with the exception of No. 1, are more suitable for dress and fancy fabrics than for trousering and coating textures. They are too bright for the latter types of loom products, but are of the correct depth of colour for fancy dress and mantling fabrics.

151. *Compounds composed of Three Types of Elementary Colouring.*—In the above example in Compounds, only two schemes of colouring obtain; but in Fig. 103 three elementary systems of grouping shades have been combined, yielding a style rich in diversity of small types of design. The schemes of shades employed in this construction are the I., II., and IV. Methods in Class A of the Simple Colourings. They constitute, in the fabric, nine distinct effects. These must be closely examined, in order that the principles of pattern design involved in the formation of the Compound style may be understood. Commence with the three effects succeeding each other in Bracket A. First, there is a square of similar minute figuring to that noticed in C of Fig. 102; second, a rectangle of vertical stripes composed of neat markings; and third, a repetition of the effect seen in D, Fig. 102. Next, consider the types included in

Bracket *B*. The first space here is a composition of the small checks referred to in Section *A* of the former pattern; this adjoins a square filled in with vertical stripes; and then follows a space of similar dimensions, and of the same species of effects, as characterizes *B* of the preceding style. Both the *A* and *B* series of these effects comprise two types of pattern like those composing Fig. 102, but in the *C* and *E* groups five entirely distinct types of textural work are developed. Two of these—the two vertical stripes—have been alluded to. The horizontal stripes, comprised in Bracket *C*, have not been described. They are similar to the stripes seen in Bracket *E*, only they are formed across instead of lengthways of the fabric. Between the rectangular spaces of these effects there is a square of black and white plaid. It may be useful to indicate how the several effects forming this compound may be utilized on other

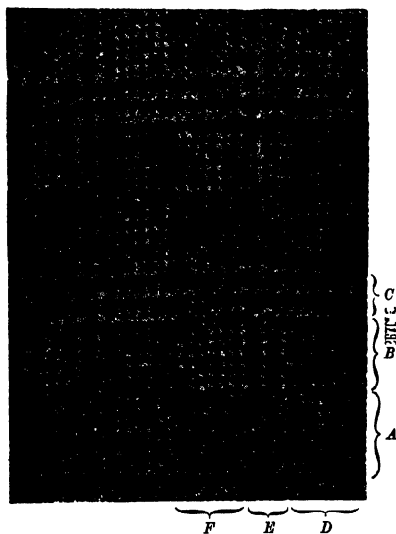


FIG. 103.

systems than that illustrated. The space of black and white checkings may be enlarged. But it is not simply in the form of checks these sets of colourings are combinable, for they may be associated on such principles as to yield an extensive range of stripe designs. Take, for example, the series of effects included in Bracket *A*. These of themselves make a neat stripe, especially if choice colourings are selected. Parts *D*, *E*, and *F* may be varied in dimensions according to the class of texture being manufactured. About half an inch of *D*, an inch of *E*, and half an inch of *F* makes a useful base. In the shades and tints furnished for the preceding example—Fig. 102—this form of stripe produces attractive styles.

The group of types in *B* should be similarly employed as that constituting *A*. After *B* sections have been separated from the rest of the pattern they may be used thus for a dress fabric:—A band of two inches of the effect given over *F*, and bands of one inch in width of the two adjacent types. If the style is applied to trouserings, smaller quantities of each type should be employed, and some fancy twist yarns added to the shades forming the bulk of the pattern, to give freshness and diversity of colouring.

The series of broken or irregular types included in Bracket *C* may also be worked into stripes for mantlings. In woollen yarns and mellow colourings, these broad effects in bands of about an inch in width yield effective patterns. Toned browns, slates, drabs, light greys, light olives, and lavenders are appropriate colours for this kind of textiles. Mixture yarns, of which several illustrations are given below, are also applicable.

## I.

- \* { 1 thread of No. 1, Plate XIII.
- { 1    "    No. 2, Plate XIII.
- \* { 2 threads of No. 1, Plate XIII.
- { 2    "    No. 2, Plate XIII.
- \* { 4    "    No. 1, Plate XIII.
- { 4    "    No. 2, Plate XIII.

## II.

- \* { 1 thread of No. 6, Plate XIII.
- { 1    "    No. 8, Plate XIII.
- \* { 2 threads of No. 6, Plate XIII.
- { 2    "    No. 8, Plate XIII.
- \* { 4    "    No. 6, Plate XIII.
- { 4    "    No. 8, Plate XIII.

## III.

- \* { 1 thread of No. 5, Plate XIII.
- { 1    "    No. 7, Plate XIII.
- \* { 2 threads of No. 5, Plate XIII.
- { 2    "    No. 7, Plate XIII.
- \* { 4    "    No. 5, Plate XIII.
- { 4    "    No. 7, Plate XIII.

152. *Results of Combining Simple Colourings*.—It will be obvious from these illustrations—Figs. 102 and 103—that, by combining several schemes of Simple Colouring, patterns are obtained rich in diversity of types of textural design, though the number of shades combined may be limited. This is not

For any suitable number of threads and picks.

usually the case in Simple Colourings. If the shades in such arrangements are not numerous, the resultant effect is invariably plain; whereas, it is obvious that in Compounds, even should one weave only be employed and two shades combined, styles full of detail and minute textural patterns are producible. They represent an economical method of developing design in woven goods, for they are neither complicated in weave structure nor colour composition.

153. *Compounds and Weave Combinations compared.* — Patterns of a Compound class, being composed of two or more Simple schemes of colouring, may be compared to designs resulting from combining several small weaves or crossings. Compound colourings bear the same relation to the general classes of coloured patterns, as combined weave designs bear to the effects obtainable by diversifying the systems of crossing warp and weft yarns. Thus, the former are the resultants of combining elementary schemes of colouring, and the latter the resultants of uniting elements of weaving. Moreover, the complexity of weave compounds is proportionate to the variety of weaves combined, and the class of the elementary schemes of intertexture employed. The complex arrangement and fullness of detail of Compound Colourings are determined by the number of "Simple Orders of Colouring" entering into their composition, and by the character of the methods of colouring utilized.

When constructing weave combinations, only those weaves should be used which fit with each other correctly, and which yield a fabric regular in structure; and when forming compounds, those schemes of elementary colouring should only be combined which produce a properly balanced style.

154. *Utility of a Practical Knowledge of the Woven Effects of Simple Colourings.* — Before attempting to combine simple methods of arranging shades, in the construction of Compound patterns, the textural results of the various elementary systems of grouping colours already described should have been ascertained, if possible, by loom experiments. For the purpose of facilitating the combination of Simple Colourings, it will be found advantageous to make a collection of the woven patterns

resulting from the adoption of the Schemes given in Paragraph 149 (see Plate XXII.). The utility of such a series of woven specimens may be indicated. Supposing, for example, a pattern were required in the cassimere twill in which the two-and-two and the one-and-one schemes of colouring were to appear. Then, by consulting the woven results of these two principles of grouping yarns, some calculation could be made of the actual aspect of the pattern to be originated. This, of course, is an advantage in designing. The most effective styles are those which the designer, by the aid of his technical knowledge, has been able to partially imagine the woven effect of, when the patterns were in the theoretical form.

155. *Compound Patterns Subjective to the Nature of the Fabric Manufactured.* — Another factor which affects the selection of "Simple Colourings" in the construction of Compounds, is the class or description of fabric being produced. In some species of cotton and dress textures, bold and broad effects are required, necessitating the use of the larger types of elementary colourings; but in ordinary fabrics the neatest and smallest types are suitable. This may be regarded as a general rule, but the degree of colour contrast, and the fineness of the structure of the fabric, in some measure also modify the type of shade-arrangements most appropriate for any specific class of fabrics. It is chiefly a question of the size of the pattern required, which governs the dimensions of the various effects combined in its construction. So that, granting the class of fabric has been selected, and that its structure is known, then those Simple Colourings may be applied which will give a compound style of requisite textural composition, form, and size.

156. *Types of Compounds.* — Compounds, like Simple Colourings, may be divided into Regulars and Irregulars, which may be subdivided thus: Compounds composed of two elementary schemes of colouring, and Compounds composed of three or more elementary schemes of colouring. Each of these subdivisions includes styles of two, three, or four shades. Examples in these several classes of Compounds are supplied in the Table given below.

TABLE XI.

## COMPOUND COLOURINGS.

## REGULAR COMPOUNDS—

CLASS A.—COMPOUNDS COMPOSED OF TWO SIMPLE TYPES.

• I.—*Styles in Two Shades.*

<i>I. Scheme.</i>		<i>II. Scheme.</i>	
1 thread of black.	} A.	2 threads of black.	} A.
1 " white.		2 " white.	
2 threads of black.	} B.	4 threads of black.	} B.
2 " white.		4 " white.	

<i>III. Scheme.</i>		<i>IV. Scheme.</i>	
3 threads of black.	} A.	4 threads of black.	} A.
3 " white.		4 " white.	
6 threads of black.	} B.	8 threads of black.	} B.
6 " white.		8 " white.	

*II.—Styles in Three Shades.*

<i>I. Scheme.</i>		<i>II. Scheme.</i>	
1 thread of black.	} A.	2 threads of black.	} A.
1 " grey.		2 " grey.	
1 " white.		2 " white.	
2 threads of black.	} B.	4 threads of black.	} B.
2 " grey.		4 " grey.	
2 " white.		4 " white.	
 <i>III. Scheme.</i>		 <i>IV. Scheme.</i>	
3 threads of black.	} A.	4 threads of black.	} A.
3 " grey.		4 " grey.	
3 " white.		4 " white.	
6 threads of black.	} B.	8 threads of black.	} B.
6 " grey.		8 " grey.	
6 " white.		8 " white.	



TABLE XI.—*continued.**III.—Styles in Four Shades.*

<i>I. Scheme.</i>		<i>II. Scheme.</i>	
1 thread of black.	} <i>A.</i>	2 threads of black.	} <i>A.</i>
1       "     dark grey.		2       "     dark grey.	
1       "     grey.		2       "     grey.	
1       "     white.		2       "     white.	
2 threads of black.	} <i>B.</i>	4 threads of black.	} <i>B.</i>
2       "     dark grey.		4       "     dark grey.	
2       "     grey.		4       "     grey.	
2       "     white.		4       "     white.	
<i>III. Scheme.</i>		<i>IV. Scheme.</i>	
3 threads of black.	} <i>A.</i>	4 threads of black.	} <i>A.</i>
3       "     dark grey.		4       "     dark grey.	
3       "     grey.		4       "     grey.	
3       "     white.		4       "     white.	
6 threads of black.	} <i>B.</i>	8 threads of black.	} <i>B.</i>
6       "     dark grey.		8       "     dark grey.	
6       "     grey.		8       "     grey.	
6       "     white.		8       "     white.	

## CLASS B.—COMPOUNDS COMPOSED OF THREE SIMPLE TYPES.

<i>I. Scheme.</i>		<i>II. Scheme.</i>	
Composed of Two Shades.		Composed of Three Shades.	
1 thread of black.	} A.	1 thread of black.	} A.
1 " white.		1 " grey.	
2 threads of black.	} B.	1 " white.	} B.
2 " white.		2 threads of black.	
4 threads of black.	} C.	2 " grey.	} C.
1 " white.		2 " white.	
		4 threads of black.	} C.
		4 " grey.	
		4 " white.	

TABLE XI.—*continued.**III. Scheme.*

Composed of Three Shades.

1 thread of black.	} A.
1   "   grey.	
1   "   white.	
3 threads of black.	} B.
3   "   grey.	
3   "   white.	
6 threads of black.	} C.
6   "   grey.	
6   "   white.	

*IV. Scheme.*

Composed of Three Shades.

2 threads of black.	} A.
2   "   grey.	
2   "   white.	
4 threads of black.	} B.
4   "   grey.	
4   "   white.	
8 threads of black.	} C.
8   "   grey.	
8   "   white.	

## IRREGULAR COMPOUNDS—

*I. Scheme.*

Composed of Two Colours.

2 threads of black.	} A.
1 thread of white.	
4 threads of black.	} B.
2   "   white.	

*II. Scheme.*

Composed of Two Colours.

1 thread of black.	} A.
1   "   white.	
3 threads of black.	} B.
1 thread of white.	

*III. Scheme.*

Composed of Two Shades.

1 thread of black.	} A.
1   "   grey.	
1   "   black.	
1 thread of grey.	} B.
1   "   black.	
1   "   grey.	

*IV. Scheme.*

Composed of Three Colours.

6 threads of black.	} A.
4   "   grey.	
2   "   white.	
3 threads of black.	} B.
3   "   white.	

NOTE.—Groups *A*, *B*, and *C* may be repeated to any number of threads of which they form a multiple.

157. *Compounds composed of Two Simple Types.*—Four examples in this class of Compounds are given in Class A of the Table. Three of them have been examined—namely, Schemes I., II., and III. The I. Scheme is analyzed in Paragraph 150,

the II. Scheme produces a common check pattern, and the III. Scheme the basket check. Scheme II. is used in worsted designing for both suiting and dress fabrics, and also in cotton yarns. Both this and the III. Scheme are worked in the mat or hopsack, as well as in the four- and six-end twills. These forms of pattern also obtain in stripes and checks. No great contrast of colours is needed, as they are effective in a textural sense. The difference between the effects of the two-and-two and the four-and-four, and the three-and-three and the six-and-six orders of colouring, is so pronounced as to make decided shade composition unnecessary. Colours of the same hue, but of various depths, are appropriate. Another useful type of colour compound for these schemes of grouping shades is illustrated below:—

I.	II.
A. { 2 threads of brown. 2 „ brown and light brown twist.	A. { 2 threads of light grey. 2 „ light grey and white twist.
B. { 4 threads of brown. 4 „ brown and light brown twist.	B. { 4 threads of light grey. 4 „ light grey and white twist.

Parts *A* and *B* may be repeated two, four, or six times, according to the size of pattern required. A very mellow sort of style results from this system of colouring. The surface of the texture is one uniform tint, slightly diversified with the twist yarns, which develop the details of the pattern, due to the method of grouping the threads. This species of colouring is soft in tone and artistic in composition, being equally applicable to woollen, worsted, and cotton fabrics. In cottons, more pronounced colouring may be adopted, such shades as follow being useful: brown and slate, pink and white, and deep blue and pale lavender.

The woven effects of Scheme IV. are given in Figs. 104, 105, and 106. The weave employed in the production of these patterns is an eight-shaft twill. Whatever twill were used, providing it flushed the warp and weft equally, the general aspect of the patterns would be as here illustrated. In order to afford a clear insight into the principles of Compound Colour-

ings as possible, the effect of changing the weft on the pattern resultant, when the system of warping is not varied, is also shown in these examples. All the three patterns have the same arrangement of warp yarns, but in Fig. 104 the weft is white; Fig. 105, black; and in Fig. 106 it is like the warp. If the weft contrasted in hue with both the shades of warp yarns, quite a new type of effect would be acquired. Supposing, for illustration, it were blue. Such an alteration would completely change the appearance of the fabric. Neither the black nor the white stripes would be solid,

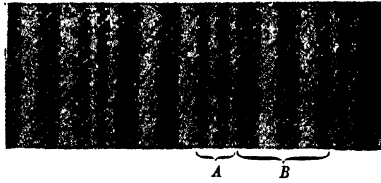


FIG. 104.

but the former would be half black and half blue, and the latter half white and half blue. However the weft might be varied, the form of the pattern would remain the same—that is to say, it would always consist in the stripes (Figs. 104 and 105) of four broad lines and two narrow lines, and in the check (Fig. 106) of sixteen large and sixteen small squares.

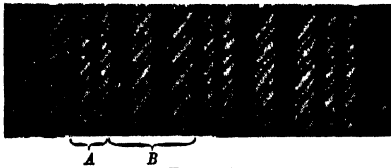


FIG. 105.

Considering that only two shades are used, the patterns are full of textural detail. The series of effects given are useful in textile designing. The

stripes possess diversity of composition, and are characterized by neatness and clearness of arrangement. Seeing that the shades used are black and white, the absence of bold and stiff outlines is an interesting feature, and one that suggests the utility of the base in the development of fancy fabrics. In the check there is much variety of work. In addition to the solid squares of black and white of two sizes, there are rectangles composed of twills of black and white blended, of several dimensions and shapes.

158. *Patterns composed of Two Types and Three Shades.*—Scheme I. of Class A of the Regular Compounds, in the styles composed of three colours and of two Simple types, gives some-

what mellow and subdued effects. The patterns sketched in Figs. 107 and 108 illustrate the style of design arrangement resultant when this method of colour-grouping is adopted. The stripe pattern has a mingled appearance. Parts *A* of both the check and the stripe are composed of minute work, which neatly contrasts with the broader and more distinctly pronounced effects comprised in Section *B*. The patterns have a softer aspect and tone than if only two shades had been employed, the third shade adding diversity of colouring and freshness of the

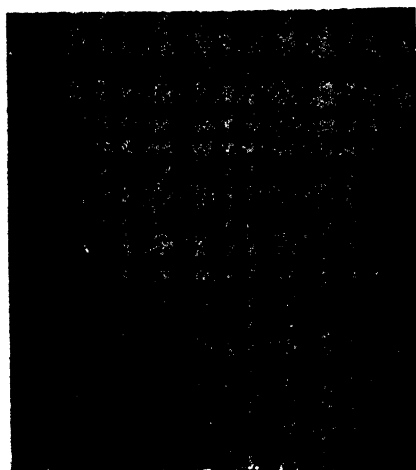


FIG. 106.



FIG. 107.



FIG. 108.

style. Fig. 107 is woven with a white weft, and Fig. 108 with exactly the same order of weft as warp shades. The two Simple schemes, forming this Compound, combine satisfactorily. The three-odd-thread grouping, constituting the *A* sections of the fabric, yields a species of textural effect which affords prominence to the small spaces of black, grey, and white composing parts *B*. There is, in these samples, congruity of effects. This is one of the main elements of a well-arranged compound. It is a feature of all descriptions of designing that the styles amalgamated should suitably develop each other, and yield a well-balanced and effective scheme of ornamentation. Even in the smallest textural effects, resulting from combining various systems of

shade-arrangement, this principle of design has to be taken into account. For example, the check style given in Fig. 111 would not form a satisfactory pattern if combined with the check in Fig. 108; although both styles are composed of similar arrangements of shades, and have precisely the same colour features. The character of the respective checkings is, however, very different. In Fig. 111 the patches of colours are so grouped as to yield a broad and clearly-pronounced series of effects, whereas Fig. 108 is a compound of various minute types of woven design; hence the incongruity which would ensue from their amalgamation. The elements of Figs. 107 and 108 are, on the other hand, suitable for this purpose. The stripe is a style that may be utilized in various ways. Should, for instance, bands *A* and *B* be varied in width, a range of useful patterns for dress and mantling textures may be produced. Thus, stripes averaging from two to four inches in width, in mellow shades of twist or self-coloured yarns arranged on this system, are developed largely in worsted, woollen, and cotton materials.

In the check, Fig. 108, the development of this Compound scheme of colouring is shown. It is made up of the two types lettered *A* and *B*. Several groups of shades are given below illustrative of the type of colouring appropriate for the respective textures named.

## I. CLOAKINGS.

*Example A.*

For 12 threads.	{	1	thread of fawn.
		1	„ light brown.
		1	„ brown.
For 24 threads.	{	2	threads of fawn.
		2	„ light brown.
		2	„ brown.

*Example B.*

For 12 threads.	{	1	thread of light olive.
		1	„ slate.
		1	„ medium blue.
For 12 threads.	{	2	threads of light olive.
		2	„ slate.
		2	„ medium blue.

## II. DRESSES.

*Example C.*

For 24 threads.	{	1 thread of white.
		1 „ lilac (Tint 16, Plate VI.).
		1 „ olive (Shade 9, Plate VI.).
For 48 threads.	{	2 threads of white.
		2 „ lilac (Tint 16, Plate VI.).
		2 „ olive (Shade 9, Plate VI.).

*Example D.*

For 24 threads.	{	1 thread of yellow olive (Tint 10, Plate VI.).
		1 „ light blue (Tint 11, Plate IV.).
		1 „ olive (Shade 8, Plate III.).
For 48 threads.	{	2 threads of yellow olive (Tint 10, Plate VI.).
		2 „ light blue (Tint 11, Plate IV.).
		2 „ olive (Shade 8, Plate III.).

*Example E.*

For 6 threads.	{	1 thread of light brown (No. 3, Plate IV.).
		1 „ medium brown (No. 2, Plate IV.).
		1 „ dark brown (No. 1, Plate IV.).
For 12 threads.	{	2 threads of light brown (No. 3, Plate IV.).
		2 „ medium brown (No. 2, Plate IV.).
		2 „ dark brown (No. 1, Plate IV.).

*Example F.*

For 6 threads.	{	1 thread of brown and white twist (No. 3, Plate IV.).
		1 thread of blue and white twist (No. 9, Plate IV.).
		1 thread of olive and white twist (No. 15, Plate IV.).
For 12 threads.	{	2 threads of brown and white twist.
		2 „ blue and white twist.
		2 „ olive green and white twist.

. The II. and IV. Schemes of the styles in three shades of class A (see Table of Compounds) are not illustrated. The

former style is most frequently worked in six-shaft weaves, and the latter in four- and eight-shaft weaves. On account of the colours being grouped in larger quantities than in Scheme I., they give patterns of a broader and more effective character. They are used for similar classes of textiles as those to which Scheme I. is applicable, being selected when styles composed of well-emphasized types of textural work are required. Should

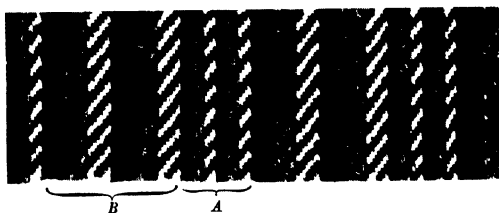


FIG. 109.

thick yarns be used, they give an excellent form of pattern for travelling rugs, shawls, and wraps.

The III. Scheme of these styles, consisting of three shades and of two simple types, is illustrated in the three patterns in Figs. 109, 110, and 111. The patterns are twice the size of Scheme III., that is to say, they contain fifty-four instead of twenty-seven threads, as given in the Table of Compounds, for

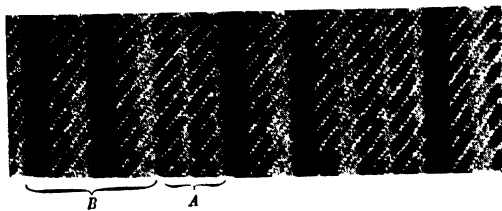


FIG. 110.

Sections *A* and *B* in producing the fabrics have both been repeated. Types *A* and *B* here combined work well together, and form a species of pattern which may be dissected. Contrast the effect obtained in Fig. 109 with the effect obtained in Fig. 110. The arrangement of shades in the warp is the same as supplied in the Table in both styles; but in the former the weft is black and in the latter white. Had a blue shade of weft yarn been employed, or any colour which would have formed an equal



weight of contrast with the black, grey, and white elements of the patterns, a species of design comprising increased effects would have resulted; or, had fancy colours instead of neutral shades been combined, a more elaborate type of colouring would have been produced. But to revert to the contrast of style due to changing the weft. It illustrates the importance of employing the proper shade of weft for developing the various elements of coloured styles. Each example is applicable to the dress and mantling branches of weaving, while in certain shades producing

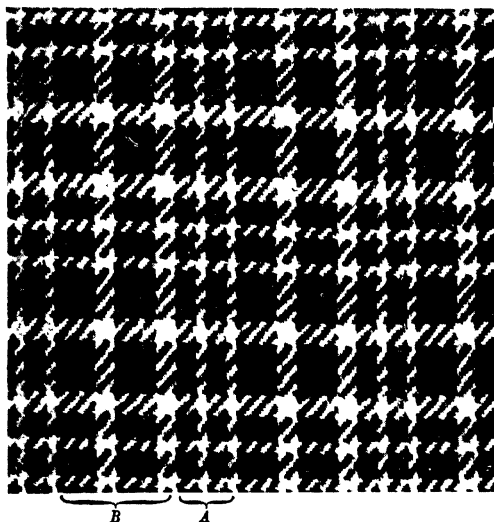


FIG. 111.

subdued and toned effects, they are used in trousering patterns. For dress textures, Sections *A* and *B* require to be increased in width in order to give more character and breadth of effect to the colourings.

Fig. 111, which is composed of the same warp yarns as the two preceding examples, and woven with a similar order of weft as warp colouring, is an effective plan of arranging shades. In Fig. 109, the black lines in parts *A* and *B* are quite solid, and the white and grey effects broken, being crossed with black; in Fig. 110 the white lines are clear, and the grey and black mingle with white; but in Fig. 111 Sections *A* and *B* each contain rectangular spaces of various sizes and shapes of black, grey,

and white yarns. These blend and interlace with each other. Part *A* of this style, being composed of the three-threes system of grouping colours, consists of a smaller series of effects than Part *B*, which results from the three-sixes plan of combining shades. The dimensions of each section of the pattern are varied according to the description of fabric in which it is developed.

159. *Styles of Four Shades containing Two Simple Types.*—

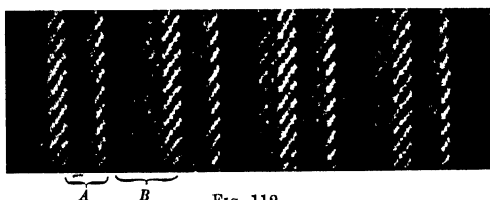


FIG. 112.

Four examples are given in these styles in Table XI. They do not form patterns so rich in mingled effects as the preceding compounds. This arises from their occupying an even number of threads, and constituting, as a consequence, a more regular and set description of pattern. Schemes I., II., and IV. are not illustrated, but they produce a similar species of style to

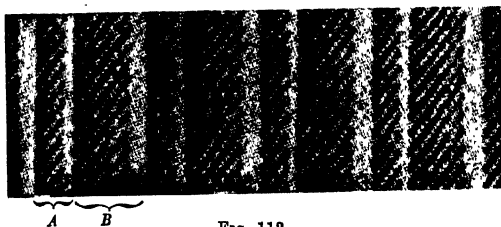


FIG. 113.

that resulting from Scheme III. in Figs. 112, 113, and 114. These types resemble each other in outline and textural detail. The only difference consists in the sizes of the effects produced. This is not the case in Schemes I. and II. of the styles in Three Shades, in which Parts *A* are composed of an odd and Parts *B* of an even number of ends. When the composition of the two types combined is thus dissimilar, the resultant compound is fuller of effects than if the two Simple Colourings both comprised an even number of threads. By, however, resorting to the use

of fancy weaves, the textural appearance of the patterns referred to may be considerably diversified.

Figs. 112, 113, and 114 have been acquired in the cassimere twill by repeating *A* and *B* of Scheme III. of the styles of Four Shades in Class A. In Fig. 112 the weft yarn is black; in Fig. 113, white; and in Fig. 114, the same as the warp. By using grey and light grey wefts, other stripes may be obtained. A contrasting shade of weft also forms a useful class of effects. Both Figs. 112 and 113 are bases employed in various kinds of

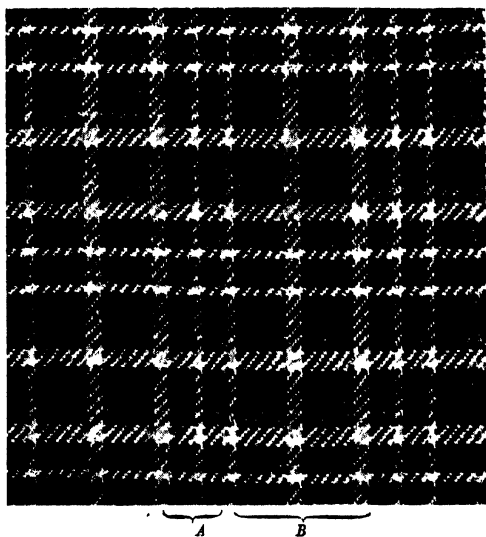


FIG. 114.

woollen, worsted, and cotton textures. In Fig. 114, the black weft destroys the effect of the warp shades, hence brown, blue, or olive would be more suitable. The check is regular in arrangement. It is a common base, and is employed in larger or smaller forms in the construction of dress and other fabrics.

160. *Styles composed of Three Simple Types* (see Table of Compounds).—As pointed out in reference to Fig. 103, which results from the adoption of Scheme I. of Class B (see page 200), when three elements of Simple Colourings are combined, a pattern is acquired rich in diversity of textural work. This is apparent in the example. Composed of black and white yarns,

it is a specimen of the diversity of style obtainable with two shades in compound patterns. It follows that if the number of the shades employed is increased, designs richer in character are

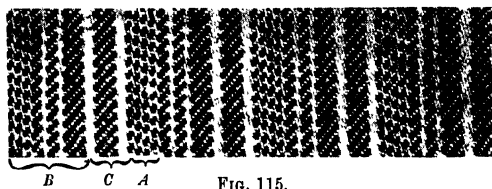


FIG. 115.

producible. If Figs. 115, 116, and 117, which have been woven from the arrangement of shades supplied in Scheme II. of Class B, are examined, it will be noticed that though the number

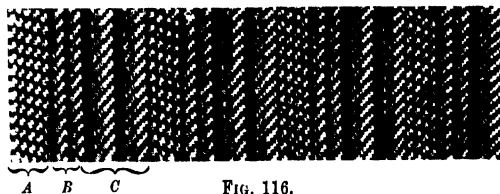


FIG. 116.

of effects corresponds with that of Fig. 103, yet the addition of the grey tint has produced quite a different form of style. Figs. 115 and 116 have been woven with white and black weft

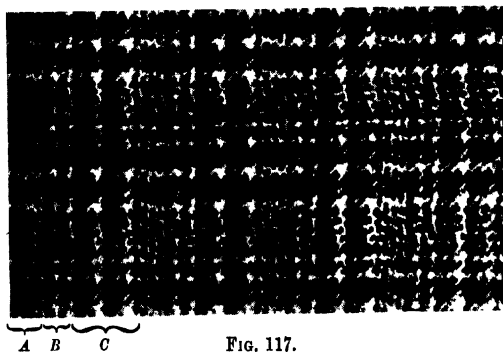


FIG. 117.

respectively. They are composed of three types of work, comprising minute effects in *A*, somewhat larger effects in *B*, and still broader details in *C*. The patterns are partially shaded, and as bases of colouring they are excellent. The three effects

each contains, may be combined in various ways, giving stripes of suitable proportions for dresses, mantlings, and trouserings, according to the class of materials employed. A few examples in colouring this base are given. Any of the three shades of which they are severally composed may be used for weft.

*I. Example.*

For	{	1 thread of brown (No. 1, Plate IV.).
6 threads.		1 " blue (No. 7, Plate IV.).
		1 " olive (No. 13, Plate IV.).
For	{	2 threads of brown.
12 threads.		2 " blue.
		2 " olive.
For	{	3 threads of brown.
18 threads.		3 " blue.
		3 " olive.

*II. Example.*

For	{	1 thread of olive (No. 9, Plate VI.) and white twist.
6 threads.		1 " blue (No. 9, Plate IV.) and white twist.
		1 " slate and white twist.
For	{	2 threads of olive and white twist.
12 threads.		2 " blue " "
		2 " slate " "
For	{	3 threads of olive and white twist.
18 threads.		3 " blue " "
		3 " slate " "

*III. Example.*

For	{	1 thread of light blue (No. 10, Plate IV.).
12 threads.		1 " rose (No. 4, Plate IV.).
		1 " white.
For	{	2 threads of light blue.
12 threads.		2 " rose.
		2 " white.
For	{	3 threads of light blue.
36 threads.		3 " rose.
		3 " white.

IV. *Example.*

For	{	1 thread of russet (No. 7, Plate III.).
12 threads.		1 " olive (No. 8, Plate III.).
		1 " slatish purple (No. 14, Plate VI.).
For	{	2 threads of russet.
12 threads.		2 " olive.
		2 " slatish purple.
For	{	3 threads of russet.
18 threads.		3 " olive.
		3 " slatish purple.

The I. and II. Examples are for suitings—one for dark and the other for light fabrics. These may be produced in either woollen or worsted yarns. Example III. is for dress fabrics. The two smaller types of work of which it is composed form the same size of section in the texture; but the arrangement of the three 3's yields a section half as large again as that formed by the other elements of the style. A bold and clearly-defined pattern is thus produced by this order of colouring.

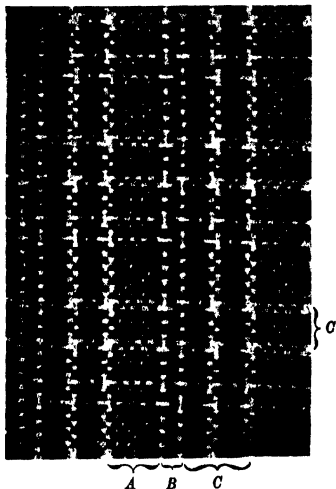


FIG. 117A.

Example IV. is intended for cloakings, and is composed of shades of a medium depth and intensity.

The checks, Fig. 117, in  $\frac{2}{2}$  twill, and Fig. 117A, in the  $\frac{2}{2}$  mat, contain nine species of work, well grouped and arranged. The two types A and B are just sufficiently emphasized to contribute to the neatness of the style, while the series of effects comprised in Bracket C give a distinctness of outline. These checks are workable in the colourings supplied for the stripes.

It is unnecessary to illustrate Schemes III. and IV. of Class B of the Table, which give similar patterns to those described, though there is considerable dissimilarity in the types of effect making the respective patterns.

161. *Irregular Compounds* (see Table XI.).—Styles of this class are generally quite mingled in colouring. They consist of such methods of grouping threads as comprise various quantities of the different colours used. Thus, in Scheme I. of the Irregular Compounds there are twice as many threads of black as white in both sections *A* and *B*; in Scheme II. the black again predominates; while in Scheme IV. the several shades occur in different quantities. This is the colour feature which causes the dissimilarity between Irregular and Regular Compounds. In Part *A*, Scheme III., there is an excess of black, but in Part *B* an excess of grey. This species of pattern is therefore obtained by taking a simple base, in which one shade is in excess, and repeating it for a suitable number of threads, and then reversing the positions of the shades. The following examples of this system of compounding elementary schemes of colouring may be considered in addition to that supplied in Scheme III. of the Table:—

*Example I.*

- A. For { 4 threads of black.  
18 threads. { 2 „ brown.
- B. For { 2 threads of black.  
18 threads. { 4 „ brown.

*Example II.*

- A. For { 4 threads of brown.  
16 threads. { 2 „ slate.  
                  { 2 „ blue.
- B. For { 4 threads of slate.  
16 threads. { 2 „ blue.  
                  { 2 „ brown.
- C. For { 4 threads of blue.  
16 threads. { 2 „ brown.  
                  { 2 „ slate.

In the *A* section of Example I. black is the principal and brown the secondary shade, but in the *B* section the positions of the colours are reversed. Such a method of colouring frequently yields attractive styles. This scheme in the four-shaft mat produces a twofold effect. Section *A*, when this colouring is worked in the mat, forms a black ground on which

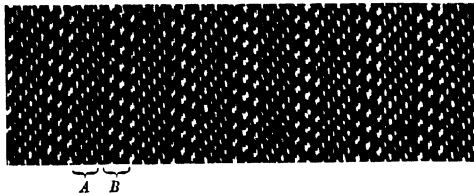


FIG. 118.

small lines of brown are set at right angles to each other, but Section *B* gives a brown ground with a similar series of black lines. The style is produced in both wool and cotton materials in the plain, twill, and mat weaves.

Example II. illustrates the method of changing the positions of the shades when three colours are employed in this class of

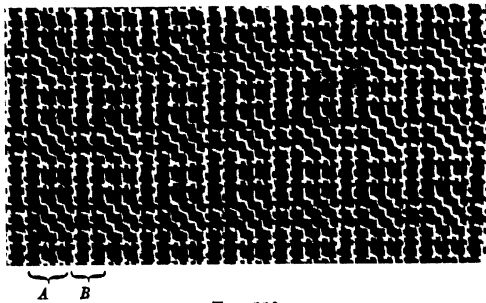


FIG. 119.

compounds. No perfect style can be obtained on this system unless each colour occupies every possible position in the repeat of the pattern. Reference to this example will make this point evident. Here three colours—brown, slate, and blue—are combined. In Part *A* the brown leads, in Part *B* the slate leads, and in Part *C* the blue. Even distribution of colouring is thus secured, and the production of a pattern in which uniformity of effects is paramount is effected. The principle of the compounds



illustrated by these examples affords considerable scope for ingenious arrangement of colours.

Two of the Irregular Compounds given are illustrated by sketches of woven samples, namely, Schemes I. and IV. . Figs. 118 and 119 have been produced by Scheme I.,—Section *A* being repeated to 18, and Section *B* to 18 threads. As this

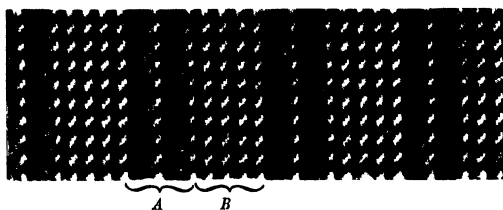


FIG. 120.

style is only composed of two shades, the textural result is somewhat wanting in variety of effect. Still, it is a useful base. Both the stripe and check arrangements are developed in woollen and worsted yarns. The check pattern is a compound of three effects, consisting of the spaces of vertical lines of black

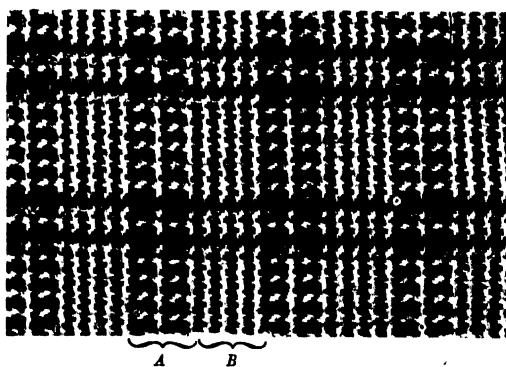


FIG. 121.

and white, of the parts of intermingled colouring, and of the sections of minute twilled work. In such couplets of shades as brown and fawn, blue and slate, and olive and slate and white twist, neater patterns may be obtained by this base than are producible in black and white.

Scheme II. gives even more mingled styles than those resulting from Scheme I. It is a composition of a Regular

and of an Irregular type; for grouping *A* is the simplest scheme of textile colouring, but grouping *B*, containing three elements of black to one element of white, is an Irregular base. This

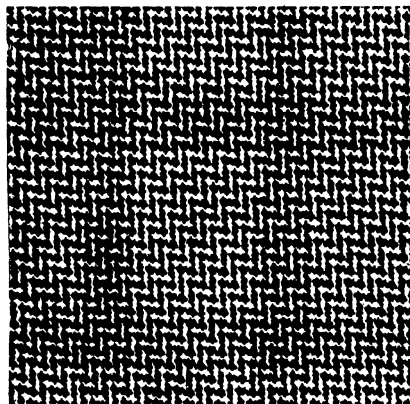


FIG. 122.

arrangement is extended and worked out in a considerable diversity of weaves. Scheme IV. is also constructed on this system. Part *B*, in this instance, is composed of the Regular

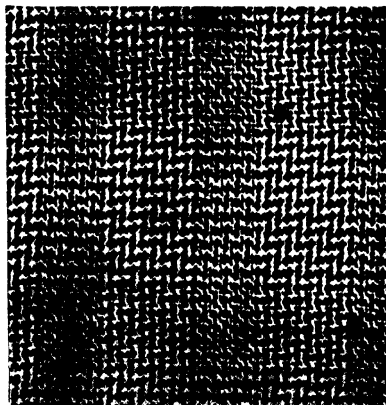


FIG. 123.

elementary type, and Part *A* of the Irregular type. The class of patterns it yields is illustrated in Figs. 120 and 121. The former of these styles has been woven with black weft, and the latter with the same shades of weft as warp. Part *A* has been repeated

to twenty-four, and Part *B* to twenty-four threads. More decided patterns generally result from combining Irregular and Regular types, than from combining two or more systems of each of these representative schemes of textile colouring. In the check pattern, Fig. 121, the Irregular type, constitutes broad rectangular spaces of white, grey, and black, which surround a series of small black and white checks. A diversity of shades and tints may be practised here, and the base modified and utilized in the construction of fancy fabrics of various descriptions.

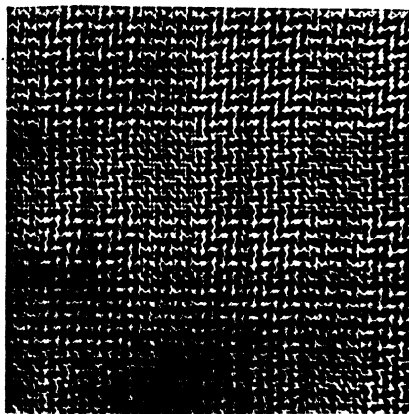


FIG. 124.

Figs. 122, 123, and 124 are other examples of compounds, the arrangement of the colours being as follows:—

*Fig. 122.*

3 black.	}	For 72.
3 white.		
4 black.	}	For 30.
2 white.		

*Fig. 123.*

3 black.	}	For 54.
3 white.		
2 black.	}	For 36.
1 white.		
1 black.		
2 white.		

*Fig. 124.*

3 black.	}	For 24.
3 white.		
2 black.	}	For 36.
1 white.		
1 black.		
2 white.		

They show how the simple grouping of colours may be effectively modified. In Fig. 122, the modification results in a compound of 3-and-3 and 4-and-2 colouring; the latter, causing the check to appear shaded on account of the 4-and-2 colouring, has one-sixth more black yarn than the 3-and-3. Fig. 123 consists of 3-and-3 colouring combined with 2, 1, 1, 2; and Fig. 124 of the same colourings differently grouped together.

## CHAPTER X.

### FANCY SHADES APPLIED TO SPECIAL DESIGNS.

162. Colour applied to Special Makes—163. Colouring of Corkscrews—164. Modified Corkscrews—165. Fancy Woollen Weaves—166. Granite Effects—167. Diagonals—168. Diagonals composed of Plain and Double Plain Makes—169. Stripe and Check Colourings on Diagonals—170. Methods of Colouring Fancy Weaves for Cottons or Silks—171. Gauze Textures—172. Systems of Colouring Gauzes—173. Imitation or Mock Gauzes—174. Colour in relation to Rib or Cord Styles.

162. *Colour applied to Special Makes of Cloth.*—Having examined the various schemes of grouping shades in relation to the elementary order of weaves, and also the methods of combining colours in both warp and weft, analysis may next be made of the principles of textile colouring for the development of specific woven effects. Here it may be an adaptation or an origination of a scheme of shades—the structure of the weave being the principal modifying factor. It is not now a matter of the application of a system of colouring, irrespective of any particular type of weave, but a question of employing that assortment of colours which will prove most effective in a certain design. The build of the fabric, the method of intertexture, and the weave, are fixed factors; and it becomes a problem of what grouping of threads will yield the most satisfactory style and best emphasize the design elements. All weaves employed in developing colour effects in simple fabrics belong to one of the orders of crossings given below:—

I. Weaves in which there is a preponderance of warp.

II. Weaves in which there is a preponderance of weft.

III. Weaves in which the warp and weft effects are equally pronounced.

The I. class of weaves, which may be termed 'warp effects, in-

cludes corkscrews, sateens, buckskins, certain species of diagonals and twilled mats; the II. class—weft weaves—is not so comprehensive, being composed mainly of ribs or cords, twills and small diagonals. A very extensive series of fancy makes of various types is found in the III. class.

But in addition to these important orders of intertexture, practised in the construction of single-make fabrics requiring special plans of colouring, there are some kinds of backed and double weaves that are so unique in build as to need exceptional treatment in a colour sense. This, however, is not so largely the case in backed as in double-make cloths. Backed, and also some types of double textures, such as trouserings, coatings, and simple effects in mantlings, are practically coloured on the same principles as single cloths. The under surface of these builds of woven styles is occasionally distinctive in shade-arrangement, but the face generally corresponds in scheme of colouring to single-make textures. In the combinations of double weaves, the exceptions to this method occur. Double-plain fabrics, for example, are coloured on quite distinct principles from some other descriptions of pattern. The double-plain weave is adapted to the development of a specific range of style, due to the utility of a formula of colouring only applicable to its structure. Some other types of double weaves have also their peculiar orders of shades.

163. *Colouring of Corkscrews.*—As corkscrews form one of the principal types of warp weaves, the application of colours to their construction may be primarily considered. The methods of colouring adopted here, relate collaterally to other weaves in which the warp effect is the most clearly developed on the face of the fabric. Corkscrews are adapted for several orders of warp colouring. Fancy shades are specially distinct when introduced into the warp of textures in which such weaves are used, making strong contrasts and high colourings in the warp unnecessary. But while these weaves thus afford ample provision for various methods of tinting in the warp, they neutralize the effects of weft colouring. This might be changed from black to dark blue in the common corkscrew without the character of the face of the fabric undergoing any perceptible modification in hue. If, for example, the warp and weft were,

in such a weave, twelve threads of brown and twelve threads of blue, a stripe, and not a check, pattern would result. Of course in a common twill this colouring would yield a decided check. There are two reasons why in corkscrews, warp cords, and similar weaves, such a scheme of shades forms a stripe—first, because textures composed of this class of weaves possess a warp face; and second, because they, if properly made, contain a larger proportion of warp than weft threads to the inch; hence the weft yarns are almost entirely concealed by the warp. On these grounds it will be obvious that variety of pattern in these weaves, when due to colouring, is a product of the warp. To the typical methods, therefore, of grouping fancy shades in the warp for corkscrew and kindred weaves, attention has mainly to be directed. In such instances, the weft is the factor which binds the threads together, and produces or builds, in conjunction with the warp yarns, the fabric; and hence it only to a small degree affects the style of the pattern, and consequently is a minor consideration in producing the design.



FIG. 125.

Patterns illustrative of the ordinary methods of colouring applied to corkscrew weaves are given in Figs. 125, 126, and 127. The style in Fig. 125 is a combination of three effects, viz., of the bands of solid colour, of the stripes *A*, and of the stripes *B*. The textural types, seen in the lettered sections, are due to two distinct but simple schemes of grouping shades, namely, the one-and-one and the two-and-one systems. They frequently occur in this weave, giving neat effects. The plan of warp colouring is as appended:—

		18 threads of black worsted.
<i>A.</i>	For	{ 1 thread of white silk.
	9 threads.	{ 1    „    black worsted.
		17 threads of black    „
<i>B.</i>	For	{ 1 thread of white    „
	10 threads.	{ 2 threads of blue    „

Should part *A* be modified thus:—1 thread of white and 1 thread of black for six threads; 1 thread of white and 1 thread of crimson for three threads; and 1 thread of white and 1 thread

of black for six threads—a very different style would ensue. Section *A* would, in this arrangement, consist of two small stripes of twills of black and white separated by a minute band of fine twills of crimson and white. Another alteration of this base, which is also frequently adopted, is as follows:—

		9 threads of black.
		9 „ brown.
		9 „ black.
<i>A.</i>	For {	1 thread of brown.
27 threads.	1 „	black.
		9 threads of black.
<i>B.</i>	For {	1 thread of tan silk.
6 threads.	1 „	black.
<i>C.</i>	For {	1 thread of slate silk.
6 threads.	1 „	black.
<i>D.</i>	For {	1 thread of tan silk.
6 threads.	1 „	black.

On analyzing this group of shades it will be evident that it comprises several elements. First, there are the three nine-thread stripes, viz., black, brown, and black. These are succeeded by stripe *A*, composed of twills of black and brown. Between this part and Sections *B*, *C*, and *D* there is another series of nine threads of black. Coming to the last three groups, the black yarns alternate with both the tan and slate silk in succession—an arrangement which tends to mellow the effect of the bright hues here employed. Of course the number of threads in the several sections of this pattern of warp may be varied according to the dimensions of the style required.

Two further examples developed in warp corkscrew are those in Figs. 126 and 127, the colourings being:—

For Fig. 126:—

	For 4. {	1 thread of lavender.
	1 „	black.
	1 „	lavender.
	For 4. {	1 „ lavender silk.
	1 „	black.
•	1 „	lavender silk.



For 4.	{	1	thread of lavender.
		1	„ black.
		1	„ lavender.
For 30.	{	1	„ lavender.
		1	„ slate.
	{	1	lavender silk.
		1	„ slate.
	{	1	brown silk.
		1	„ slate.
	{	1	lavender silk.
For 30.		{	1
		{	1

*Weft.*

All one shade.

FIG. 126.

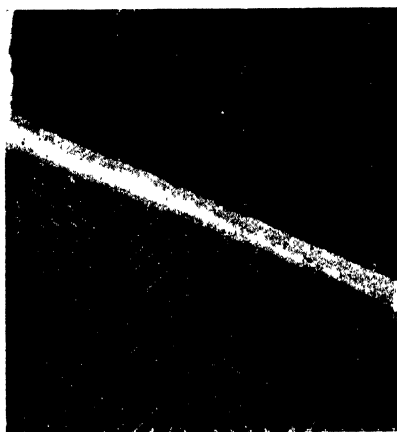


FIG. 127.

For Fig. 127:—

For 108.	{	1	.	.	.	Shade 1.
		1	.	.	.	„ 2.
For 6.	{	1	.	.	.	„ 1.
		1	.	.	.	„ 3.
For 6.	{	1	.	.	.	„ 1.
		1	.	.	.	„ 2.
For 6.	{	1	.	.	.	„ 1.
		1	.	.	.	„ 3.

*Weft.*

All one shade.

164. *Modified Corkscrews*.—In order to obtain a weft effect in corkscrews, the weaves are altered in the principles of construction. Take an example. The weave supplied in Fig. 128 is in reality a corkscrew, for should the ☒'s be erased and the ■'s be added, the weave, though occupying twenty-four threads,—which is not a number on which this type of weave is usually constructed,—would possess the main features of this description of twill. But the weave must now be considered as being composed of the □'s and ☒'s only --the ■'s corresponding to the □'s. The thread-and-thread scheme of warping in this modified corkscrew has a different effect from what it has in the common type of this weave. Taking the shades to be brown and slate, and the weft blue, a pattern containing four species of work results. First,

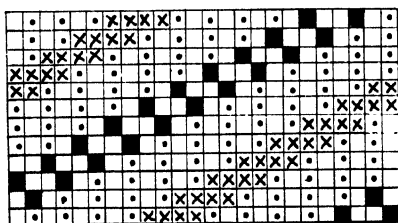


FIG. 128.



FIG. 129.

there are the two fine twills of the respective shades of warp yarn; and, second, a furrow of intermingled colouring, due to the solid floats of warp in the design. These effects are purely warp products. In addition to these, a fine diagonal of blue, resulting from the flushes of weft, is also formed, so that an alteration of this kind in the corkscrew system of twilling considerably increases the diversity of work producible by a simple arrangement of shades.

Another very useful style might be developed in this crossing (Fig. 128) by warping nine threads of a dark and three threads of a light shade of yarn, and weaving with a medium colour of weft. Supposing the shades to be black and white for warp, and grey for weft, then a pattern consisting of a series of furrows of black interrupted by small effects of white, arranged on a grey surface, would result.

In Fig. 129 is given the effect of twilling this weave, Fig. 128,

to the right and left alternately, when the thread-and-thread system of warping is adopted, and when the weft is all one colour. If the ordinary build of corkscrew had been employed, the diagonal of black and white would only have been produced. The grey twills are distinctly a weft development, and result from the  $\boxtimes$ 's in the weave. This and the preceding examples are but types of the styles producible, by modifying this useful weave, in worsted fabrics.

165. *Fancy Woollen Weaves*.—There is not a large diversity of weaves employed in the construction of woollen fabrics; still there are some crossings used in these textures which require



FIG. 130.

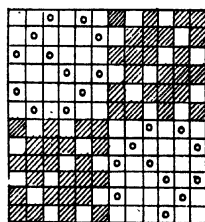


FIG. 131.

specific colouring. Patterns are produced by using weaves which are tinted on principles harmonizing with the scheme of interlacing. Such an example is given in the upper section of Fig. 130. A neat combination of textural effects has here been obtained by the employment of an uncommon weave. (See Fig. 131.) The scheme of colouring for this style belongs to the elementary class, being as follows in both warp and weft:—

A. For 24 threads.  $\left\{ \begin{array}{l} 1 \text{ thread of black.} \\ 1 \text{ " grey.} \\ 1 \text{ " black.} \end{array} \right.$

B. For 24 threads.  $\left\{ \begin{array}{l} 1 \text{ thread of grey.} \\ 1 \text{ " black.} \\ 1 \text{ " grey.} \end{array} \right.$

Hence it is the weave which has given the novelty of cast to the pattern. In a simple twill it would yield an ordinary style, but in this weave (Fig. 131) it forms a series of minute effects. The weave is of a check type, and is workable on twelve shafts. In the sections marked  $\boxtimes$  and  $\boxdot$ , the weft floats on the surface of the texture, while in the sections marked  $\square$ , the warp effect is clearly emphasized. Both warp and weft are equally prominent. But as the method of floating these threads, groups the weft effects and the warp effects alternately, the result is a pattern possessing minute markings of an interesting character. These are the products of three shades. If a twill or mat had been used, this diversity of pattern composition by three colours and simple plan of shade-arrangement would not have been possible; so that it is obvious that new systems of weaving on a small and regular base may be employed in woollen textures to advantage, if novel patterns are required. The intermingled check characteristic of the style is due to the system of grouping the shades. Thus the plan of colouring is in two parts; in *A* black is the principal, and grey the secondary shade; and in *B* vice versa. By this means, in some parts of the fabric a dark or black groundwork is figured with grey, and in others a grey ground with black. The scheme of colouring here illustrated is also applicable to worsted and cotton as well as to the woollen textures.

A different style is supplied in Nos. 1 and 2, in Plate XXIII., to that described. Its novelty is, however, due to the use of an uncommon weave; this is of a fancy twill order, being arranged on the base of the following plan of interlacing, which is the first pick of the design:—

$$\begin{array}{cccccc} 1 & 2 & 2 & 3 & 2 & 2 \\ \hline 3 & 3 & 2 & 1 & 1 & 2 \end{array}$$

Had, for instance, the six-end twill been used, the patterns would have lacked that richness of style and newness of colour by which they are characterized. It may therefore be understood that in woollens of a suiting and costume class, the weave may be arranged to add to the freshness of the styles obtainable from given methods of colouring. The scheme of shade-grouping in these samples is:—

# COLOUR IN WOVEN DESIGN.

## Pattern 1 (Plate XXIII).

4 threads of fawn.  
2 „ olive brown.  
2 „ brown.  
4 „ dark brown.  
2 „ brown.  
2 „ olive brown.

## Pattern 2 (Plate XXIII).

4 threads of grey.  
2 „ olive green.  
2 „ dark brown.  
4 „ blue.  
2 „ dark brown.  
2 „ olive green.

The order of the weft colouring for Pattern 1 is the same as the warp; but in Pattern 2 slate takes the place of olive green.

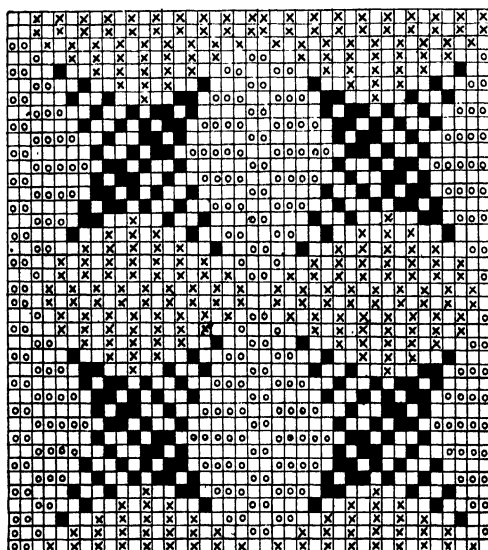
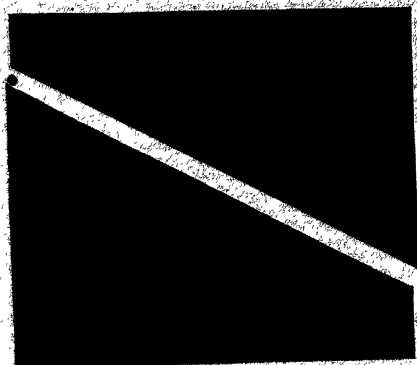


FIG. 132.

By varying the weftings, modifications of these effects may be acquired. One rule should be observed in this work—the warp colourings should slightly preponderate. They should in no case be subordinated to the scheme of wefting, which is rather a subsidiary, than a primary element, of this class of patterns.

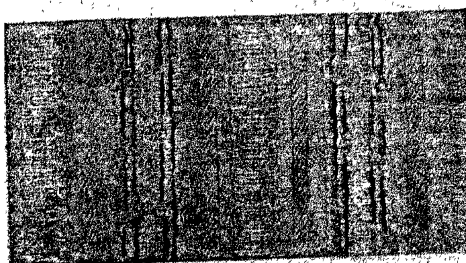
The diagonal utilized here being a combination of twills, each of which floats the warp and weft to a different degree on the face of the fabric, yields a style composed of various effects.

\*166. *Granite Effects*.—These are produced in woollen yarns, the nature of which is adapted to the construction of blended

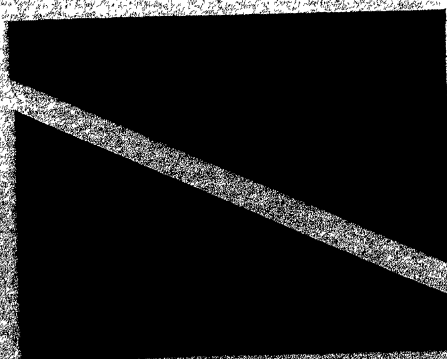


1

2



3



4

5

Plate XXIII  
CHECK AND STRIPE PATTERNS

1 and 2 Check

3 Check Stripe

4 and 5 Check Stripe



and intermingled styles. Patterns of this class may be due to the employment of special kinds of fancy yarns, or to the use of a peculiar type of weave in combination with a given order of threads. With these effects, as producible by coloured yarns, there is no need to deal, as they have been treated of with the ordinary class of mixtures. Reference may therefore be made to the function of weaves in the production of granite and other blended styles. The pattern supplied in the lower section of Fig. 130 is an example of this species of weaving. Its mottled effect is mainly due to the construction of the design used and the order of colouring practised. The weave is given in Fig. 132. It is a compound of several crossings, warp and weft cords, and warp and weft prunelle twills. The order of colouring for both warping and wefting is thus:—

For { 1 thread of black.  
24 threads. { 1 „ slatish lavender.  
                  2 threads of black.

For { 1 thread of black.  
6 threads. { 1 „ slatish lavender.  
                  2 threads of black.

For { 1 thread of black.  
10 threads. { 1 „ slatish lavender.  
                  2 threads of black.

For { 1 thread of black.  
6 threads. { 1 „ slatish lavender.  
                  2 threads of black.

For { 1 thread of black.  
26 threads. { 1 „ slatish lavender.

This scheme of warping and wefting, conjointly with the weave to which it is applied, cannot fail to give an intermingled pattern. Even if the weave were of a common class, the result of this series of shades would be a broken, irregular style; but the design is arranged on a base to give a mixed distribution of colouring. The warp and weft cords in the plan are useful weaves for mingling fancy shades, and so are the twilled weaves combined. Add to these characteristics the arrangement of the design, which groups the several weaves



into small figures of different forms. The style is workable in worsted, woollen, and cotton yarns, and in twists as well as self-colours. This assortment of weaves is appropriate for patterns in which mingled colouring, combined with a definite species of marking or textural form of effect, is required.

167. *Diagonals*.—As a rule, diagonals are but plainly coloured. Being complex in weave-construction, they do not require elaborate colouring; moreover, they are frequently of such a character as to yield intricate and textural patterns in the simplest arrangements and contrasts of shades; there are, however, some exceptions. Certain important types can only be satisfactorily developed when specific colouring is practised. Some illustrations in these may be considered. First, suppose two

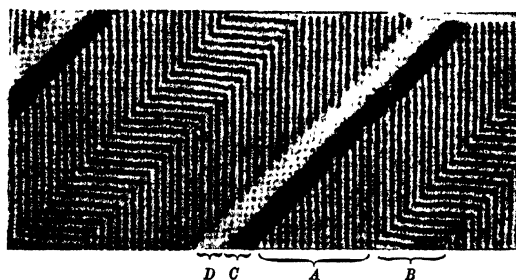


FIG. 133.

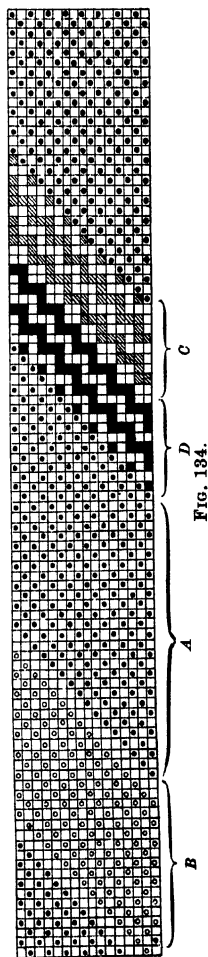
corkscrews—flushing the warp and weft respectively—were combined in a diagonal pattern of medium size. This arrangement of weaves, if the yarns were grouped on the one-and-one method in both warp and weft, would form a style in which one section of the diagonal would be developed in the warp and the other in the weft. By arranging the bands of the diagonal to run at a different angle from the twills of either the warp or weft corkscrew of which it is composed, an additional effect is obtained, than would have been the case if they had moved in a line with the twills. Regarding the application of this principle of pattern development, it relates to all diagonals composed of two or more simple weaves. One of the methods of applying colour to such designs is to adopt a simple scheme of shade-grouping, which develops neat but contrasting effects in the several makes combined.

168. *Diagonal composed of Plain and Double Plain Makes.*—

In Fig. 133 is furnished an example of how simple schemes of colouring may be made to produce quite a diversity of effects running diagonally in the fabric. This style has been developed

by arranging the colours one thread of white and one thread of black, in the warping and wefting alike, and constructing the design on the base of the sixteen picks given in Fig. 134. It is unnecessary to explain here how the several effects have resulted, as the principles involved in producing the types *A* and *B*, which are composed of plain weave, are already understood; while the varieties of patterns obtainable in the double-plain makes, forming Sections *C* and *D*, will be considered in a subsequent chapter. Still, it may be observed that in solid shades such a grouping of weaves would give but an indefinite pattern, one lacking character and precision of outline. The weaves employed in this example, are the only ones which can be made to develop effects of this order, though in some types of simple, double, or compound weaves, such figured designs are producible by dissimilar schemes of colouring. There are certain restrictions to the methods of combination. Figuring, requiring large spaces of the double-plain makes, is not feasible; these crossings are necessarily looser and more open in structure than the single weaves, and may therefore only be used in comparatively small quantities;

moreover, the weaves may not be grouped in the stripe form, or the texture will not be satisfactory as to firmness and soundness, nor will it weave regularly. The fact that the weaves in the example run diagonally, equalizes the interlacing of the warp and weft and ensures the construction of a uniformly-built fabric.



169. *Stripe and Check Colourings on Diagonals.*—Other methods of colouring weaves of a diagonal construction comprise the development of stripe and check effects, in neatly-toned shades. Coatings, dresses, and vestings comprise patterns of this order. It is necessary, in order to have the same weight of colouring in both warp and weft of such styles, to modify the design on those threads and picks on which the fancies occur. Unless this is done, the effect produced is irregular and imperfect. By, however, altering the design where these bright striping or checking shades are added, complete balance of colouring is acquired both across and lengthways of the fabric.

170. *Methods of Colouring Fancy Weaves for Cottons or Silks.*—Generally, these require brighter and more cheerful combinations of shades than woollen or worsted fabrics, but the weaves, when of a similar construction to those used in the production of these textures, are coloured on similar principles. It is in the selection of the shades where specific treatment is required. There are, however, some specially-constructed weaves employed in the manufacture of fancy cottons, and these have to be coloured according to their principles of arrangement and the type of pattern they are required to form.

Amongst these weaves are small fancy effects, such as those illustrated in Figs. 135 and 136, and leno and gauze combinations. Reference may, in the first place, be made to Figs. 135 and 136. The former is a striped pattern composed of two sateen weaves. The alternate bands have warp- and weft-flushed grounds. On the weft-flushed surface a warp spot is formed, and on the warp-flushed surface a weft spot. A marked and well-emphasized contrast of effects is thus secured. The arrangement is an excellent one, and capable of many modifications. Section *B* might, for example, be repeated several times, or the whole design might be enlarged with good results. A third variation is possible by converting the pattern into a check. A light warp and a medium shade of weft should be used. Supposing, for instance, the warp were light blue and the weft medium blue, then stripe *A* would consist of light blue ornamented with small spots of medium blue, whereas stripe *B*

would consist of medium blue mainly, with light blue spotting. This method of colouring is useful where the designs are arranged on a base of this character. Another plan of introducing fancy shades in such weaves involves the use of two shades in the warp—one for stripe *A* and another for stripe *B*.

One further method of varying styles of this kind may be mentioned. Add to the design as here given a band of fancy twill, which might be coloured with bright yarns in the warp, and the sateen sections plainly coloured, allowing of clear and distinct development of the spotting.

The next weave, Fig. 136, may be more diversified in

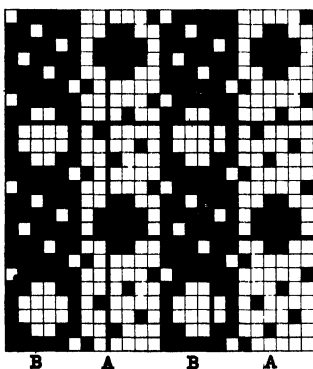


FIG. 135.

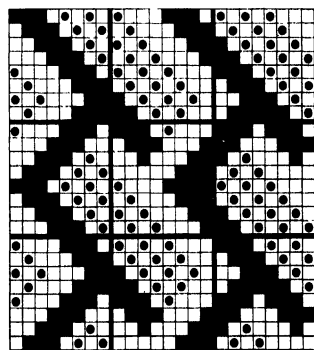


FIG. 136.

colouring. In the woven texture, it forms a species of serpentine pattern filled in with small figures of plain make. The warp and weft flushes compose similar figuring. Analysis of its composition shows that it comprises three varieties of crossings. First, there are the plain weave parts; second, the solid warp-flush figuring; and lastly, the wave effect formed by the solid floats of weft. If the thread-and-thread system of colouring were adopted, an interesting woven effect results. Thus, assuming the colourings to be pale blue and light olive, the plain sections would consist of longitudinal stripes of these colours; the blank spaces in the weave would give warp floats of the same shades; and the solid floats of weft transverse but very diminutive lines of olive and blue. Should one colour of warp yarn be used—such as light fawn, and a second colour for

weft, tannish brown, for instance—quite a different species of style would be obtained. In this example, a wave figure of light fawn would be adjacent to a similar figure of tannish brown, and the oblong figures composed of plain weave in mixed colouring.

These styles, Figs. 135 and 136, when coloured on the lines indicated, are suitable for silk and mixed materials, as well as cotton textures, for which they have been arranged.

171. *Gauze Textures*.—Gauze or leno effects are different in structure and appearance from ordinary woven fabrics. When combined with the common methods of weaving, a variety of useful designs may be obtained. Compared with ordinary

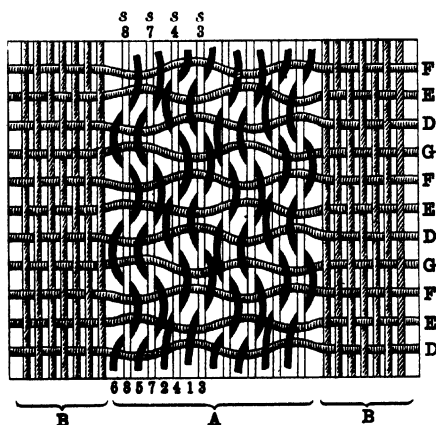


FIG. 137.

woven results they are what may be defined as porous or transparent in composition, or, more strictly speaking, they consist of compact and open spaces which regularly alternate. The dimensions of the perforations, and the intervals at which they occur, are determined by the weave used and the method of healding adopted. On examining a sample of these textures, the threads appear to be drawn together in some sections and in others to be separated and apart. Section A of Fig. 137 affords some idea of the mode in which the yarns twirl round, over, and under each other. Note, for example, the crossings of threads 1 and 2 with 3 and 4. The two former rise alternately on the right and left of the two latter. Further analysis shows that some of the threads—namely, those lettered s—are not

drawn out of their positions. They preserve uniform fixedness of position, being always under the picks of weft and twined round by the whip yarns 1 and 2, and 5 and 6, etc. If one of these yarns is removed, the whole structure of the fabric is decomposed. Fig. 138 is a photo-micrograph of a cotton warp and silk weft gauze fabric showing distinctly the twisting of the double warp threads round the soft floss weft. In the sample of fancy gauze, Fig. 137, two whip threads rise on the left and on the right of the threads

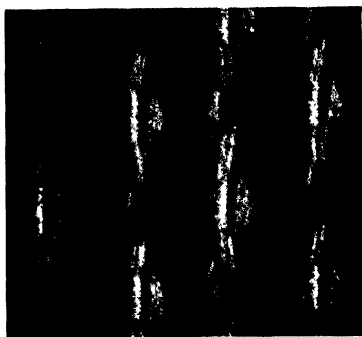


FIG. 138.

simultaneously, forming a wavy texture. The picks are introduced at such intervals as to be bound together in pairs, first by ends 1 and 2, *D* and *E*, *F* and *G*, etc.; and, second, by ends 5 and

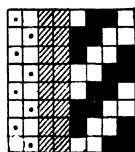


FIG. 139.

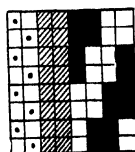


FIG. 141.

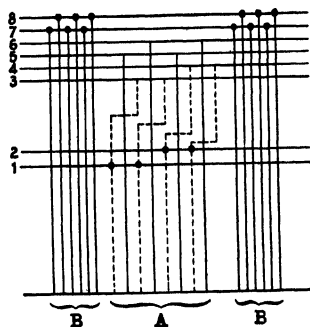


FIG. 140.

7, *E* and *F*, *G* and *D*, etc. The bending of the picks is due to the method of coupling them together. In producing such a style, first arrange for a band or stripe, of about one inch in width, of the gauze effect *A*, and then for a band of  $1\frac{1}{2}$  to 2 inches in width of the plain, like the sections lettered *B*. The weaving plan of this pattern is Fig. 139, and the healding draft Fig. 140. A word or two of explanation is necessary on the latter. Shafts

1 and 2 are the doupe heddles. In healding, the whip threads are first entered into shafts 3 or 4, then into shafts 1 or 2, as the case may be. It is necessary that these should be drawn underneath the stationary ends. When the doupe heddles rise, the whip ends are lifted on the right of the fixed threads, but when shafts 3 and 4 rise they are lifted on the left. The weave given in Fig. 141 is a modification of this structure.

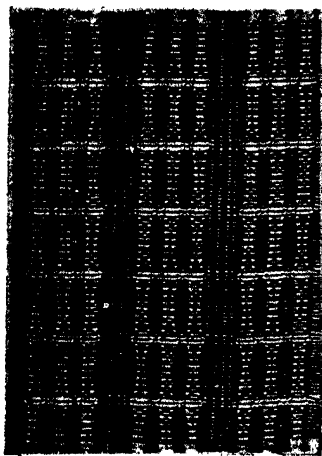


FIG. 142.

This weave, in the same draft, gives the stripes of plain unaltered, but those of leno are more pronounced in waviness, for four picks are in this case grouped together at each change of the whip threads. Numerous variations might also be wrought in the same method of healding, and by the same plan, by simply altering the dimensions of the respective stripes.

The style given in Fig. 142 is of a different class from that sketched in Fig. 137. For some sixteen picks the gauze yarns interweave regularly, and then pass round four threads, being thereby drawn together by the picks, and at the same time made to prevent them from being forced into contact with each other. It is thus that the porous features of the pattern are originated. Between each series of gauze effects there is a band of twelve threads of fine cotton, not including the side threads which, conjointly with the whip yarns, form the interstices at intervals. In healding for this style, the douping threads pass under four ends in succession, so that five threads are sleyed together in the gauze sections. In the plain parts, however, only four threads are entered into each reed, while a vacant split is allowed between the different sets of these yarns. This sample, like the preceding one, and that given in No. 3 on Plate XXIII., illustrates the diversity of textural arrangement feasible in gauze fabrics.

172. *Systems of Colouring Gauzes*.—The methods of colouring these patterns may be grouped under three heads, as follows:—

I. Gauze patterns in which colour is applied to those sections composed of the ordinary principles of intertexture only.

II. Gauze patterns in which colour is applied to the gauze parts only. •

III. Gauze patterns coloured in both the ordinary and gauze sections.


Examples in each class may be considered. Primarily, then, it is feasible to apply colour to these styles on such a system that the gauze sections will be developed in one shade, while the adjoining effects may be coloured on any system applicable to single-make designs composed of simple weaves. Thus, taking Fig. 137 as a design which it is required to colour by this method, then the weave of parts *B* being plain, any of the Simple or Compound Schemes of Colouring might be used; or these parts might be coloured on a special system to form, for example, a shaded band of tints. If the colours used were pink and white, the maximum quantities of pink could approach the band of gauze effects, when the largest portion of white would fall in the centre of the plain stripe; or the shading might proceed from white at the edges to a pink central band. Whether the first or the second arrangement is adopted, the stripe of gauze should be in white, and the weft also of this shade. Obviously the ordinary schemes of colouring are applicable to such sections as *B* of any gauze pattern. With some slight modification, or rather adaptation, they also relate to the leno or gauze portions of these styles. When it is required to introduce the fancy shades into the gauze proper, the structure of the fabric has to be taken into consideration. Fig. 142 is a sample of gauze in which the fancy yarn constitutes the gauze effect. By making it such, the character of the pattern is more clearly developed. It is only by an arrangement of this kind that the twisting of the gauze yarns can be prominently brought out. If the ground threads had been white, and the whip yarns black, the effect would not have been nearly so good. Hence it is advantageous in applying colours to these textures to make the twisting or whip threads into fancies.



Another important feature about the application of colour to gauze effects is that different materials and thicker yarns may be employed for the whip than for the ground ends of the fabric. This is the case in Fig. 142, where the gauze threads are silk and several fold in thickness. The object of this contrast of materials and in sizes of yarns is to cause the gauze effects to appear prominent and distinct from the other characteristics of the pattern.

The third example in the colouring of these styles is Pattern 3 on Plate XXIII. There are several textural principles here for analysis. The gauze sections are developed in three kinds of yarns. The variegated silk threads form the main element of the tinting. Such yarns are only used in the finest of these fabrics. They impart richness of tone and lustre to the whole effect. Next there are the thick threads of cotton forming the diamond-work in the gauze parts. Intervening these thick yarns, and constituting the smaller interstices, the fine threads occur. These various yarns are effectively employed—the silks give the twisting, the thick threads the open gauze, and the fine threads the groundwork. The other sections of the style are composed of twill and plain. Fancy shades might be forcibly added to the twilled part, and so the pattern converted into a colouring of the third class of gauze styles.

In addition to these striped combinations, a limited range of checkings in gauze are obtained, while figured effects are produced in this scheme of weaving in a considerable diversity of tints.

173. *Imitation or Mock Gauzes.*—The somewhat intricate mounting required to produce gauze fabrics has led to numerous ingenious attempts to obtain a gauze effect in the texture without increasing the complication of the weaving process. One of the most important methods of accomplishing this is shown in Fig. 143. The small weave (Section A) in this design, marked in 's, yields an imitation of the real gauze, and so groups the threads and picks that they result in forming a fabric full of small perforations. It is used in combination with the plain weave and fancy makes in the origination of various descriptions of patterns. As a rule, the colourings are of a simple order, only

a limited variety of shades being used. The stripe in Fig. 143 may be colourable in the warp as follows:—

	20 threads of tan.
32	„ light blue.
20	„ tan.
24	„ light blue.

The weft might be either light blue, tan, or a tint that would contrast with both the colours in the warp. Assuming it to be blue, the pattern resultant would consist of a stripe of mock gauze in solid blue, a stripe of plain in brown and blue neatly mingled, a stripe of hopsack in which the respective shades

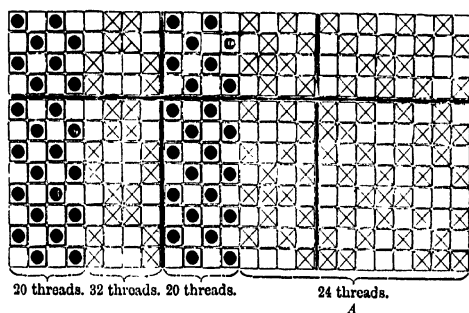


FIG. 143.

would form small diaper-work, and of a second stripe of plain weave of intermingled colouring. The novelty of these patterns is largely proportionate to the ingenuity exercised in varying the methods of combining the weaves and in the selection of new types of crossings; while the special function of the colourings is to develop the weave elements.

The check example, Fig. 144, further illustrates the method of colouring these mock effects. Fig. 144A is a photo-micrograph of the fabric, showing the interlacing of the threads, and the difference in structure of "mock" and gauze fabrics (Fig. 138). It is produced in Fig. 144B, and coloured:—

Light green .	.	12	12	12	12	24	-
White .	.	48	24	-	12	-	24
Medium green	.	-	-	24	12	12	-

174. *Colours in relation to Rib or Cord Styles.*—The rib make of cloth is utilized in the construction of fancy patterns. It is

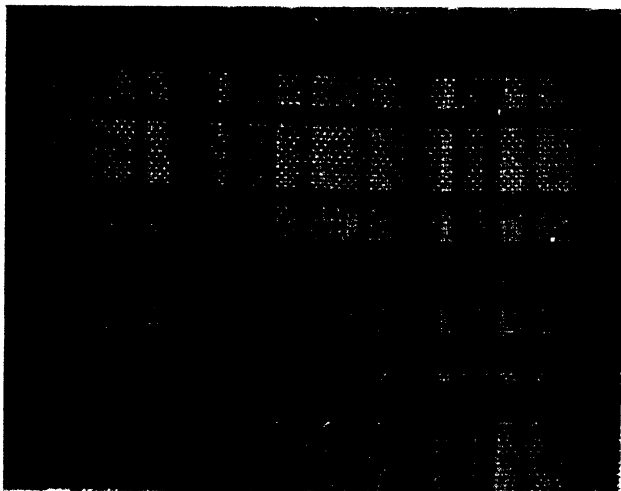


FIG. 144.

one of the neatest schemes of weaving that can be used for this purpose. It allows of considerable scope for both colouring and



FIG. 144A.

designing. Though two wefts may be employed in producing this class of design, only one of them appears on the face of the

fabric when forming the rib or cord effect. As a result of this, the cord may be variously coloured, and yet quite independently of the other sections of the style. Fig. 145, which is the plan of the rib style given in Pattern 4, on Plate XXIII., illustrates the base on which such designs are arranged. Part *A* forms the cord. It is produced solely by the even picks. These, in weaving, come as close together as if the odd picks were not part of the construction. At the same time they float under the several sets of threads forming the other parts of the style. It is this arrangement which makes it feasible to develop the cord in any order of colours without modifying the pattern as a whole. Pattern 4, Plate XXIII., shows the rib of a distinct shade. The method of colouring is as appended :—

*Warp.*

- 10 threads of brown.
- 10     "     brown and white twist.
- 20     "     brown.
- 10     "     brown and white twist.
- 10     "     brown.
- 10     "     brown and white twist.
- 6     "     brown.
- 10     "     brown and white twist.
- 10     "     brown.

*Weft.*

- 1 pick of brown.
- 1     "     black.

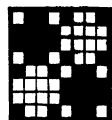


FIG. 144 B.

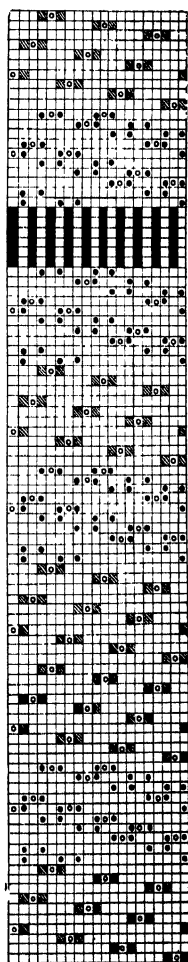


FIG. 145.

(If necessary, stitch or tie beneath the cord section *A*.)

It is the black weft which forms the cord. Greater diversity

of effect in this section of the fabric might have been acquired by wefting thus:—

For	{	1 pick of brown.
92 picks.		1 „ black.
For	{	1 pick of brown.
4 picks.		1 „ silk.

In this scheme of wefting the rib is spotted with silk. Occasionally two colours of silk are employed, so that there is evidently some facility for fancy weft tinting in designs of this character. It is not necessary to enter into the details of the warp colouring, which depend largely on the weaves combined.

Pattern 5 of Plate XXIII. is a rib of a different arrangement from that of the preceding example. In Fig. 146, used in its

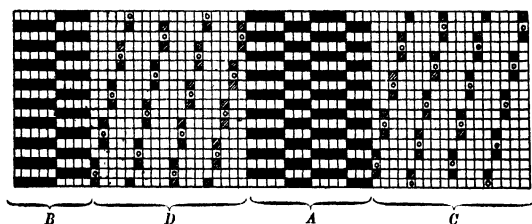


FIG. 146.

manufacture, three sizes of ribs are combined. It should be noted that where more than one rib constitutes any stripe, both the odd and even picks are utilized in forming the corded effect, and, as a consequence, it is no longer possible to have the whole of the rib stripes of a distinct weft shade from the rest of the design. If Band A only contained three ribs, the pick-and-pick method of colouring might be practised, because in such an arrangement the fine twill would start on the first pick of the design in both Sections C and D, admitting of the small ribs in A and of the large ribs in B being of a different colour from the opposing cords and also from the twilled parts. But this order of wefting, if applied to the design given in Fig. 146, would partially destroy the solidity and neatness of one of the twilled bands. Should the odd picks be selected for the heavy colour, it would be stripe C, but should the even picks be

selected, it would be stripe *D* that would be modified by the additional shade of weft.

It may be observed that as a rule weaves of a warp type are combined with corded effects; clearer patterns, comprising more forcible contrasts of textural work, result from the use of these than from employing crossings which flush a considerable proportion of the weft yarn on the face of the fabric. Mellow and choice colouring is therefore important in the warp of these styles, because the yarns composing it float with comparatively few weft interruptions on the upper surface of the texture.

## CHAPTER XI.

### COLOURING OF COMBINATION DESIGNS.

175. Principles of Colouring Weave-Combinations—176. Examples in Colouring Compound Designs—177. Main Points in applying Shades to Weave-Combinations—178. Examples in Drafted Patterns—179. Designs composed of Two Prunelle Twills—180. Drafted Designs composed of Two Four-Shaft Weaves—181. Styles composed of Prunelle and Cassimere Twills—182. Combinations composed of two-, Six-, Seven-, Eight-, and Nine-Shaft Weaves—183. Drafted Designs composed of Three or More Weaves—184. Fancy Stripe Combinations—185. Irregular Woollen Weave-Combinations—186. Cotton Stripes—187. Colouring of Designs containing several Weaves of Varied Construction—188. Figured Designs striped in the Warp.

175. *Principles of Colouring Weave-Combinations.*—In applying fancy shades to designs containing several weaves, not only has the character of the pattern as a whole to be considered, but also the character of its component parts. That grouping of shades which forms a perfect style in the common twill may yield incongruous effects in other fancy weaves with which it may be associated, necessitating in some designs—particularly in those of a stripe and check order—the adoption of various systems of colouring, according to the structure of the crossings forming the different sections of the pattern. Generally, the elementary schemes of colouring are the most appropriate for weave-combinations, as they constitute the most uniform effects. To exemplify the methods practised in colouring this description of textile designs, some illustrations may be considered in detail. Supposing, in the first place, a design were composed of prunelle twills and the plain weave, and it were required to colour it on such lines as to obtain neat textural effects in each weave. Now, it will be clearly understood from the analyses made of Simple Colourings that several schemes might be employed, so far as the plain make is concerned, such

as the one-and-one, the two-and-one, and the three-odd-thread systems; but if these analyses have been carefully studied, it will at once be evident that neither the first nor the last of these colourings would be suitable for application to this design, because, while producing satisfactory types in the plain sections, they form unsuitable ones in the twills; and it is imperative in this case to use a method of grouping shades that will give equally clear and regular effects in the prunelle as in the plain crossings. On this ground, therefore, both these systems must be rejected. There is not the same objection to the two-and-one arrangement, for it yields a good pattern in each of the makes. In the plain weave it forms a species of neat spotting; in the warp prunelle, lines lengthways of the fabric; and in the weft prunelle, lines of the two shades across the fabric.

176. *Examples in Colouring Compound Designs.*—Let the following examples also be considered: I. a design composed of four-end twill and mat; II. a design with a cassimere twill ground, small upright twill for figure, and swansdown twills for extra spotting; III. a design consisting of six-shaft twill in the ground, with warp and weft cords for figuring; IV. a design containing mayo, common twill, and mat; and V. a design with twilled mat for ground and double-plain for figuring.

In the first design mentioned, two weaves are combined in which several schemes of colouring might be utilized, such as the two-and-two, the four-and-four, and the four-two's arrangements. But assuming that it were required to adopt an order of colouring which would cause the twilled parts of the design to consist of minute checkings, and the hopsack parts of fine vertical stripes, then it would become a necessity to employ the two-and-two colouring. This order is, in some respects, one of the best that could be employed in all-over patterns consisting of twill and mat weaves, for it not only thus produces a distinct effect in both makes, which in figured styles would result in the precise development of the integral parts of the design, but also a combination in which the sections consisting of the respective crossings are equally pronounced.

The second type of design named contains four weaves, but the one most largely employed and which constitutes the ground



of the fabric is common twill. Now, in colouring such patterns the ground weave must be primarily considered, other makes, so far as the application of fancy shades to the entire design is concerned, being of secondary importance. In a combination comprising four weaves it is not, however, usual to adopt an order of shades calculated to produce a special effect in any of the crossings, but rather to employ a scheme of colouring largely composed of one shade. In other terms, it is advantageous in designs of this class to allow the bulk of the fabric to be composed of yarns of one tint—any fancy threads which may be introduced being used sparingly, and frequently singly, and not in larger groupings, as is the case in other modes of colouring. By adopting this arrangement, the weave characteristics are clearly emphasized, and yet the surface of the texture is neatly embellished with fancy shades.

The six-shaft twill is the main factor of the third type of style. It is therefore a question of selecting in the first instance a plan of colours that is adapted to its structure. As it forms the bulk of the texture, it requires to be primarily considered. Reference should be made to the series of simple and compound colourings applicable to this weave, and then that method employed which, while making a neat pattern in the twill, will not form an unattractive effect in the cord weaves. Some of the standard groupings of shades for this weave are quite unsuitable when used with these cords. The three-two's and two-three's are arrangements of this character. They form neat patterns in the twill, but imperfect styles in the ribbed crossings. The one-and-one and the three-odd-thread schemes are the most appropriate in a combination of such weaves. They are both capable of producing regular effects in this compound design. Thus, take the thread-and-thread order. In the six-end twill it forms neat spotted work; in the warp rib, transverse bands of colours; and in the weft rib, vertical bands of colours, varying in dimensions according to the size of the rib-weaves used.

The IV. class of example in mayo, twill, and mat is a combination in which several schemes of shades are feasible. The point to be acquired when such is the case, is the employment of a method of colouring that will yield effects in each weave, sufficiently

marked in character to contrast neatly with each other, and yet constitute a harmonious pattern. This can only be practically worked out by comparing the patterns resulting from each crossing in standard groupings of shades, which will lead to the application of that order of yarns known to develop forms of pattern in the respective makes, calculated to harmonize satisfactorily in combination.

When single and double weaves are combined, as in section V., the elementary schemes of colouring to be used have also to be applied in relation to the general effects producible. Fig. 147 is a pattern containing such weaves, the ground being single in structure and the figuring double-weave structure. A section is given in Fig. 148. The simplest arrangement of colouring, one-and-one, has been used, because it produces the figure in light and dark portions, and the ground in intermingled colouring. The relation of the colour effect to each weave gives satisfactory definition to the figuring in contrast with the intermingling of the shades in the ground.

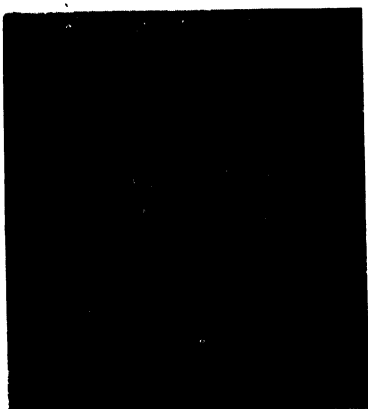


FIG. 147.

177. *Main Points in applying Shades to Weave-Combinations.*—From these examples in the methods of colouring designs consisting of several elementary crossings, it is apparent that there are certain principles which must be observed in introducing fancy yarns into this class of woven patterns. First, whatever the character of the design, the primary factor for consideration is the structure of the weaves—the weave which occurs in the largest quantities being the most important, and requiring specific colour treatment. Second, when the weaves combined are similar in construction, a simple scheme of colouring should be adopted. Third, no order of shades should be

employed which, while giving pleasing patterns in one weave, produces indifferent results in others. Obviously, these rules are only applicable to designs composed of elementary weaves, and in which the variety of crossings is very limited. For example, in designs comprising such a series of dissimilar weaves as obtains in Figs. 163 and 166, it will be clear that, to acquire a

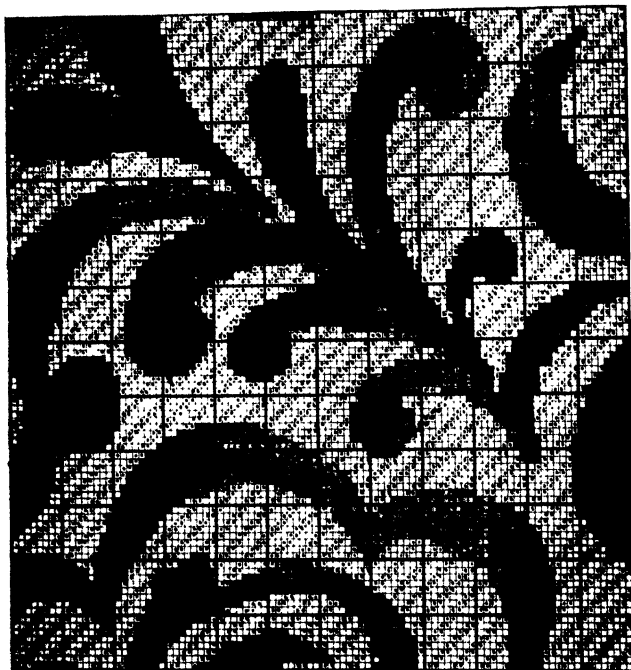


FIG. 148.

well-balanced pattern as to colouring, the several sections of the style must be specially treated in a colour sense. To warp an assortment of weaves of this type on one system throughout, could only result in the construction of a most unsatisfactory range of effects. The order of colouring must vary with the alteration in weave. This of course is only feasible in stripe and check designs, but is absolutely necessary in styles comprising a considerable diversity of intricate weaves arranged on either of these methods.

178. *Examples in Drafted Patterns.*—These may be considered as follows:—

I. Designs composed of weaves related to each other in structure and occupying a similar number of threads, and in which the several makes are used in corresponding proportions.

II. Designs of a stripe and check arrangement diversified in weave assortment.

III. Designs composed of several crossings, but with a simple twill, mat, or plain weave for the ground of the texture.

In the I. group a range of irregular patterns occur, consisting mainly of three-, four-, and six-end makes. In colouring these patterns, it is necessary to consider how the simple schemes of colouring develop in the several weaves combined, in order that the scheme which will give the most uniform result in all the crossings may be applied. If three or four weaves obtain in the same design it is occasionally advantageous to employ an irregular grouping of shades, or one which is not intended to give a particular type of pattern in any one of the weaves combined.

Increased colouring ingenuity and practical skill are required in the treatment of the second group; because in the designs included here, it is frequently necessary to adopt various orders of colouring—one for each type of weave in the design.

The third group of drafted patterns is largely developed in cotton fabrics, dress goods, and other fancy textures. The method of colouring these patterns is twofold, relating, first, to the treatment of the ground crossing, and second, to the use of a plan of shades that will yield neat effects in all the weaves combined.

Examples in each group will be fully analyzed and described.

179. *Designs composed of Two Prunelle Twills.*—An extensive assortment of styles in woollen, worsted, and cotton yarns is obtained in these two weaves by drafting. These are produced in trouserings, suitings, dresses, etc. When these two makes are combined and coloured on the two-and-one method, they give opposite effects, the warp twill forming vertical, and the weft twill transverse lines of colour. It is this principle which governs all the patterns obtained in designs composed of

these crossings. In making styles of this kind, the first work consists in mapping out the form of the design, and the second

FIG. 149.



FIG. 152.

work in running the twills on to the ground and figured sections respectively. Fig. 149 is a pattern partially constructed from these weaves. Stripes *A* are a composition of warp and weft twills. The reduced design and the draft for the same are furnished in Figs. 150 and 151. From these it will be evident that it is the transition from warp to weft twill which gives the results lettered *A* and *B* in the illustration taken from the woven fabric.

Many types of figuring, whether floral or geometrical in arrangement, can be developed on this system.

There is another mode of colouring this design besides that considered. It consists in employing three shades in single threads, but as it is somewhat more intricate than the two-and-one system, and yields a similar pattern, it is not so extensively employed.

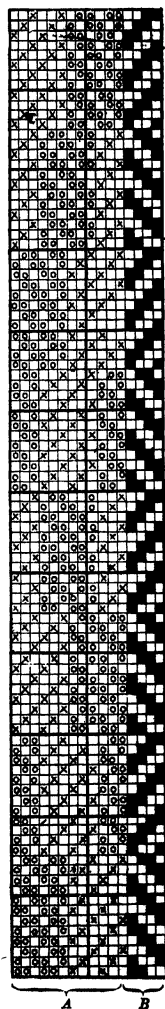


FIG. 150.

180. *Drafted Designs composed of Two Four-Shaft Weaves.*  
—These obtain in greater diversity than designs resulting from three-shaft weaves. This is owing to the considerable series of makes of twill and mat types producible on four shafts, enlarg-

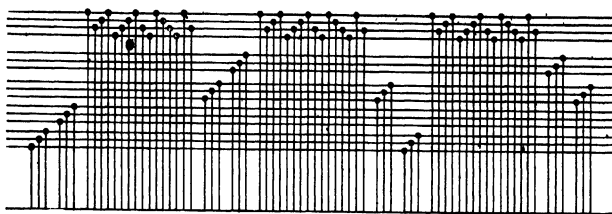


FIG. 151.

ing the scope for the origination of all classes of combination styles. Various illustrations in these designs will be examined, and the principles of colouring them explained. First, the pattern, Fig. 152, may be referred to. It has been obtained in the design and draft supplied in Figs. 153 and 154. Strictly speaking, it is composed of only one weave, which, to gain variety of effect, is twilled in two directions. It will be observed, if any of the sections are analyzed, that every other pick of this weave is plain. This accounts for the effect seen in the fabric in Fig. 152. The arrangement of the shades is one-and-one, so that one weave here being the reverse of the other, while the parts developed in ■'s are forming one textural type, the parts developed in □'s are yielding a second type. It is the plain picks of the respective sections which constitute the minute skeleton squares of grey and black; the twill picks filling up the spaces formed by the grey with black, and those formed by the black with grey. This pattern may be developed in various

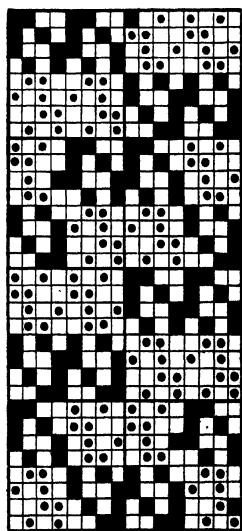


FIG. 153.

shades of fancy yarns; and the two weaves may also be blended on such methods as to form stripe and check styles of several descriptions.

The fabric given in No. 1 on Plate XXIV. has some principles of construction common with the effect just described, inasmuch as the design employed in its manufacture is a composition of cassimere weave twilled to the right and left successively. Thus,

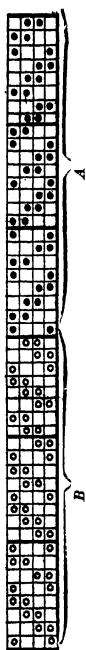


FIG. 155.

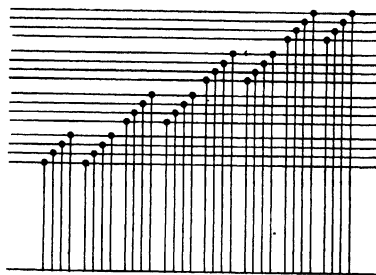


FIG. 154.

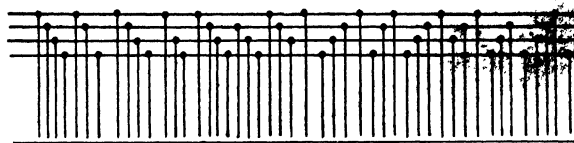


FIG. 156.

it results from the plan and draft given in Figs. 155 and 156; hence it is, in reality, a cassimere twill pattern, for this is the only weave used. But as it runs forward for six picks, and then starts again—this process being repeated throughout sections A and B, in which the weave twills in both directions—there is formed by the draft a check pattern, occupying forty-eight threads and picks, and in which the weave twills to the right in each alternate space of twenty-four threads. The order of colouring is somewhat intricate, being as appended:—

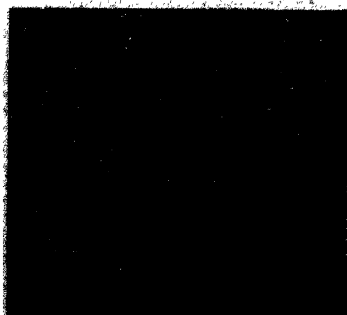
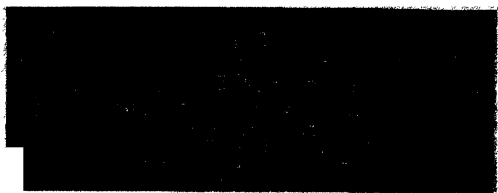


Plate XXIV

# COLOURING OF DRAFTED STYLES

Wave Compound: Pencil and  $\frac{1}{2}$  Taffin





*Warp.*

		2 threads of a dark shade.	
A.	For 16 threads.	2 " " light	"
		2 " " dark	"
		1 thread of a light	"
		1 " " fancy	"
A.	For 12 threads.	2 threads of a dark	"
		2 " " light	"
		2 " " dark	"
		4 " " light	"
		2 " " dark	"
		4 " " light	"
		1 thread of a dark	"
		1 " " light	"
		1 " " fancy	"
		4 threads of a light	"
		1 thread of a fancy	"
		1 " " light	"
		1 " " dark	"
		4 threads of a light	"
		2 " " dark	"
		4 " " light	"
		2 " " dark	"
A.	For 16 threads.	2 " " light	"
		2 " " dark	"
		1 thread of a light	"
		1 " " fancy	"
A.	For 12 threads.	2 threads of a dark	"
		2 " " light	"

*Weft.*

For 21 picks.	2 picks of a dark shade.
	1 pick of a light shade same as warp.
	2 picks of a dark shade.
	1 pick of a fancy

There is a sort of broken or irregular shading produced by this arrangement; the construction of the design having an im-

portant effect on the grouping of shades. The particles of two-and-two colouring, which occur in brackets *A*, develop, in the weaves cutting each other, the waviness characterizing the coloured effects (Pattern 1, Plate XXIV.). The comparatively large patches of one group of yarns in the warp do not form a clear stripe in the fabric, because the system of wefting is irregular, being such, however, as to tally with the plan of changing the twilling of the weave on every sixth pick. The effect of the two-and-two order of shades in the warp in this drafted design shows the extent to which the construction of the plan of interlacing may modify the result of a simple order of shades.

181. *Style composed of Prunelle and Cassimere Twills.*—This is rather an irregular combination, but in the two-and-one system of colouring, if the weaves are skilfully adjusted, it is capable of producing a species of pattern rich in textural details. Referring, for example, to section *B* of Fig. 149, the effect of the cassimere twill worked into checks of sixteen threads and picks in this grouping of shades is given. It is a neat type of pattern, contrasting with the effects of the prunelle twills with which it is combined. The quantity of cassimere twill must not be large in combinations of this class, or a cloth lacking uniformity of structure will be produced. Further, the weaves require to be correctly fitted together, or a fabric possessing an irregular surface will ensue. It is a suitable scheme of weaves for dress fabrics. The arrangement is also adaptive, in small styles, to trousering and similar fabrics.

182. *Combinations composed of two-, Six-, Seven-, Eight-, and Nine-Shaft Weaves.*—There are several varieties of patterns obtained in designs containing six-end makes. As a rule the twill is the principal weave. One example in which the hop-sack and a fancy crossing are combined may, however, be described, as it is an interesting and typical specimen of the general range of patterns obtained in this class of weaves. This style is sketched in Fig. 157, while the design producing it is a composition of the two makes in Fig. 158. The method of colouring is three threads of white and six threads of black in both warp and weft. In the mat sections the minute figures

are formed, but the intermingled checking is a consequence of the weave marked in full squares in Fig. 158. These two crossings are combinable in figured arrangements suitable for costumes and dressing-gowns. In soft colours, brightened at intervals by a few fancy threads, this compound of weaves and scheme of colouring are capable of yielding a series of fancy fabrics. By changing the mat to twill, quite a distinct species of pattern is obtained. Both weaves now yield check effects, but

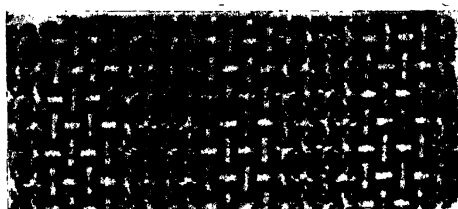


FIG. 157.

the type of effect resulting from the twill is uniform and regular in appearance. Some neat figured and check designs are also obtained in six-shaft makes by employing the twill for the ground of the texture, and small weaves which may be readily combined with it, and colouring on the three-one's, two-three's, and three-two's systems.

The variety of styles workable in seven-shaft crossings is somewhat limited. Such weaves as the corkscrew and twill, and the upright twill and small diagonals, are blended here.

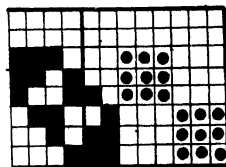


FIG. 158.

In combinations containing a large portion of corkscrew, the one-and-one method of colouring is appropriate, particularly if the make is of a common twill construction. The five-and-two, four-and-three, and six-and-one groupings of shades are useful in designs in which an ordinary seven-shaft twill forms the bulk of the texture.

Eight-thread weave combinations comprise the largest variety of styles. Designs composed of several classes of twills, of simple, twilled, and fancy mats, of minute diagonals, and small

figured types, are all colourable on the Simple and Compound systems of blending shades containing four and eight threads.

Nine-shaft compounds, consisting of weaves about equally balanced as to warp and weft floats, are principally developed in the following groupings:—

I.		II.	
5 threads of a dark shade.		7 threads of a dark shade.	
4    „        „    medium „		2    „        „    medium „	
III.		IV.	
3 threads of a dark shade.		4 threads of a dark shade.	
3    „        „    medium „		3    „        „    medium „	
3    „        „    light    „		2    „        „    light    „	

183. *Drafted Designs composed of Three or more Weaves.*—Four-, five-, six-, and eight-shaft weaves are all used in the construction of these designs, belonging to the second group, but such styles generally consist of four-end makes. For fine textures, and for fabrics in which a broad cast of pattern is required, weaves occupying a larger number of threads are employed. It will, however, be sufficient if illustrations are considered in designs composed of the four-thread weaves. These are given in Nos. 2 and 3 on Plate XXIV. They are taken from woollen textures. The colourings are as follows:—

#### PATTERN I.

##### *Warp.*

2 threads of white.  
 1 thread of black and scarlet.  
 2 threads of white.  
 1 thread of black and green.  
 2 threads of white.  
 1 thread of black and white.

##### *Weft.*

Medium grey.

## PATTERN II.

*Warp.*

For 9 threads. { 1 thread of black and brown.  
 1 „ brown and white.  
 1 „ scarlet and green.  
 For 9 threads. { 1 „ brown and white.  
 1 „ black and brown.  
 1 „ blue and green.

*Weft.*

1 pick of black.  
 1 „ black and white twist.

Referring to the draft (Fig. 159), and the reduced design for Pattern 2 (Fig. 160), these are arranged to form the same series

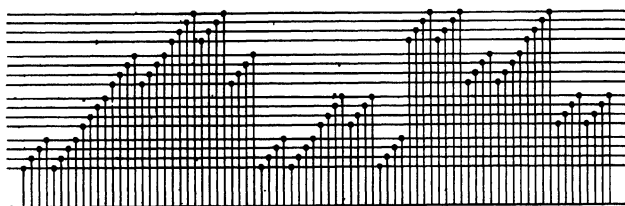


FIG. 159.

of interlacings on each thread, which ensures the construction of a regularly-built fabric.

It will be noticed that both plans of colouring are irregular, the first scheme containing nine, and the second scheme twenty threads. Now as the weaves forming the designs are on four shafts, the fancy yarns fall on different threads of the respective makes in different parts of the figuring. In this way a blended effect is acquired. The bulk of the first warp being white, and the weft of a medium shade, the weave details are clearly seen. The three makes, comprising the design (Fig. 160), are all traceable. The small spaces of white are due to the twill marked in crosses; the spaces of slate to the twill marked in full squares; and the spaces of slate and white, equally mixed, to the cassimere twill which forms the ground of the design. When the warp consists of broad bands of neatly contrasting shades, this type of

weave-combination gives excellent results in dress and mantling fabrics.

Pattern 3, Plate XXIV., though produced in the same draft and composed of similar weaves as Pattern 2, is very different from it in appearance and composition. It forms a type of granite mixture. The colours being arranged practically on the one-and-one system throughout the fabric, the effects of the various crossings are partially subdued. Cheviot yarns and medium counts of worsteds are adapted for this type of intermingled pattern in fancy costume fabrics.

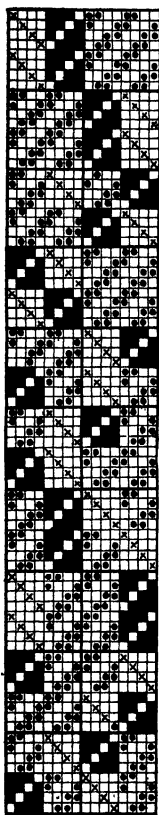


FIG. 160.

184. *Fancy Stripe Combinations.*—Designs of this class for worsted trouserings, cotton textures, and tweed mantlings, may be intricate in both weave and colour composition. Indeed, it follows as a natural sequence that if a striped design is well diversified in weave arrangement, it will be correspondingly complex in colouring. Not only in a weave, but in a textural and colour relation, is there intricacy of technical contrivance in these fabrics. First, a uniform texture is indispensable; second, this quality must be obtained in conjunction with novel weave effects; and, third, the arrangement of colouring must be harmonious in shading and in accordance with the structure of the weaves combined.

185. *Irregular Woollen Weave Combinations.*—A compound of crossings, forming a style of design specially suitable for woollen yarns, is supplied in Fig. 161. Whether produced in fine or medium yarns for dress or cloaking fabrics, it forms an effective pattern. It is workable on fourteen healds, the plan of drafting being as follows: Threads 1 to 14 straight drawn, then shafts 6, 5, 4, 3, 2, 1, 7, 8, 14, 13, 12, 11, 10, and 9. Should this method of drafting be adopted, Parts A and B

would constitute the reduced plan. Though the design contains fourteen distinct threads, it is, nevertheless, merely a modification of the first seven ends. These form a species of diagonal weave suitable for worsted coatings.

The arrangement of this pattern may be divided into four sections. Parts *C* and *D* have the diagonal moving to the right, and parts *A* and *B* to the left. The manner in which each diagonal commences and terminates is the chief characteristic of the pattern, and is illustrative of a method of combining this type of weave that may be followed out with satisfactory results. For dress

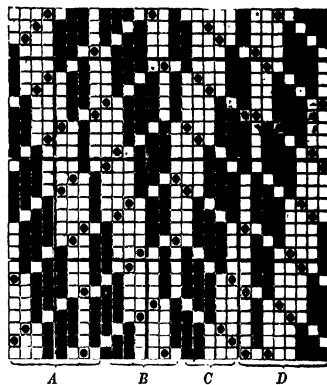


FIG. 161.

materials the following weaving particulars are appropriate:—

*Warp.*

1 thread of fine black and white twist.

5 threads of medium grey.

1 thread of fine black and white twist.

*Weft.*

All dark grey.

Little variety of colouring is needed; a light shade of warp and a medium shade of weft are sufficient to give due precision and proper development to the various features of this design.

186. *Cotton Stripes*.—These have frequently a plain ground, and belong to the third group of drafted designs. The figuring is developed in warp and weft flushes neatly grouped in diamonds, twills, and fancy mats. An example of these designs is Fig. 162—a compound weavable on twelve shafts. It consists of bands of plain weave, warp rib, and wave effect. Section *A* consists of objects of the same shape and dimensions developed in both warp and weft floats. Thus, while the figure marked in solid squares would, in the fabric, be composed of weft flushes,



the part marked in crosses would consist of floats of warp; hence, providing the warp is light in shade, and the weft of an intermediate colour, these figures would be of distinct

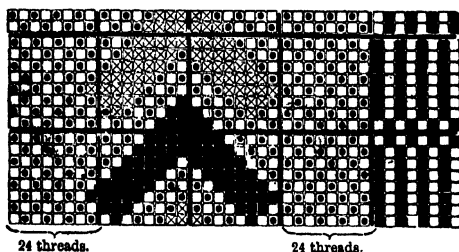


FIG. 162.

hues. The following scheme is illustrative of the methods generally adopted :—

*Warp.*

	2 threads of lavender.
4	„ white.
2	„ lavender.
4	„ white.
2	„ lavender.
4	„ white.
2	„ lavender.
16	„ white.
2	„ lavender.
For 18 threads.	{ 4 „ white.
	{ 2 „ lavender.
	8 „ bright blue.

*Weft.*

All lavender.

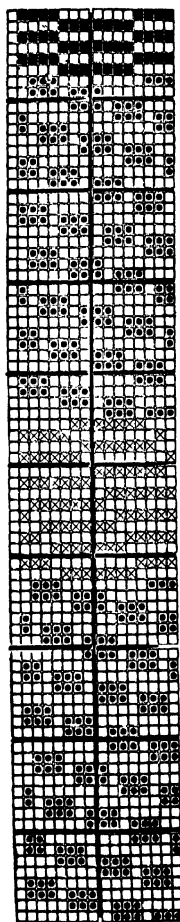


FIG. 163.

According to this arrangement of colours the rib section would consist of furrows of bright blue and lavender, while the bands of plain would be divided into stripes of solid lavender of two threads each, and of mixture stripes of white and lavender of two and four threads in width. As to the Section A, the effect in warp flushes would be solid white on a ground of

lavender and white; whereas the effect in weft floats would be solid lavender on the same mixture ground. This order of colours, but in different shades, such as pink and white, slate and white, and salmon and white, also develops well. In these latter shades, bright and pale pinks, and salmon and a deep and pale slate, are requisite to obtain the proper gradation of tinting.

187. *Colouring of Designs containing several Weaves of Varied Structures.*—Three typical illustrations in the methods of introducing fancy shades into this sort of compound designs may be considered. They are given in Figs. 163, 164, and 165. These examples show how full of weave effect, styles of this class may be. Thus, in the first design, Fig. 163, which is composed of three weaves, there are four distinct stripes, consisting of fancy mat weave, corkscrew, and rib respectively. An effective method of colouring such a compound is as follows:—

		10 threads of light mixture.
	10	„ medium mixture.
	10	„ light mixture.
For	( 1 thread of light mixture.	
15 ends.	( 1	„ medium mixture.
		10 threads of light mixture.
	10	„ medium mixture.
	10	„ light mixture.
	2	„ medium blue silk.
	2	„ white silk.
	2	„ medium blue silk.

According to this system of colours, the rib section consists of medium blue and white silk, the bands of fancy mat of stripes of light and medium mixture yarns, and the section of corkscrew, being warped thread and thread, consists of diagonals of the two shades of yarns employed.

Fig. 164 is a composition of vertical and oblique twills, with a strong contrast in the weave effect. The make marked in □'s forms an oblique twill, of about the same degree as the upright twill yielded by the crossing developed in solid marks. In combination, the weaves, though dissimilar in woven results,

produce a uniform texture. The following is an appropriate scheme of colouring:—

	8 threads of blue.
	3    „    slate.
	2    „    brown and white.
	3    „    slate.
	8    „    blue.
	8    „    brown.
Repeat	{ 1 thread of brown.
	{ 1    „    black and crimson.
	{ 1    „    brown.
	{ 1    „    black and green.
	8 threads of brown.

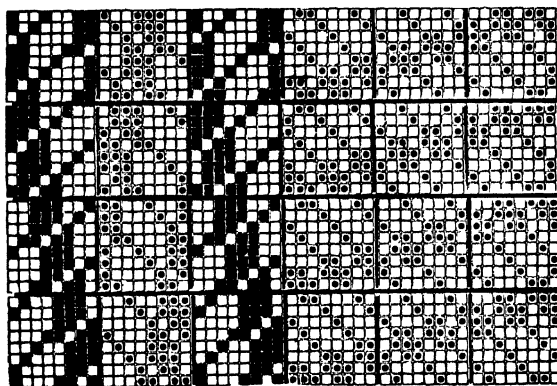
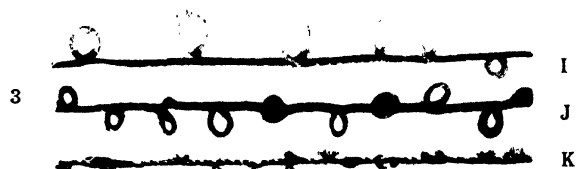
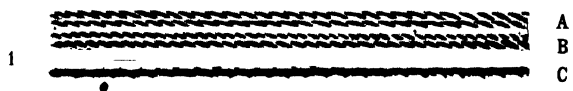


FIG. 164.

The centre of the large band of twenty-four threads is thus neatly tinted with fancy twist threads; while the diagonals developed in ■'s are composed of the blue, the same diagonal, when twilling to the right, consists mainly of slate, with a fine line of brown and white twist down the centre. There is, therefore, not only in this arrangement an apt grouping of shades in a colour sense, but the plan of adjustment produces a form of stripe in keeping with the construction of the design.

The subsequent three-weave stripe—Fig. 165—is composed of an uncommon set of crossings, namely, of sixteen-shaft twilled



# Plate XXV

## FANCY YARNS

1. Ordinary Folded, or Two-Ply and Three-Ply Yarns
2. Flakes and Cloud Twists
3. Curl Twists
4. Gimp ..



hopsack, of an eight-shaft diagonal, and of a fine warp cord. The threads making the cord section ought to be on a separate beam.

A good system of introducing colour here consists in shading

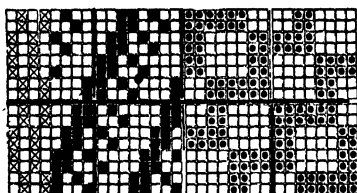


FIG. 165.

the diagonal with colour, as indicated in the plan of working given below:—

16	threads of	slatish green.
4	„	light brown.
4	„	medium brown.
4	„	dark brown.
4	„	white silk.

The depth of the brown and the slatish green must be about the same; if anything, the latter should be the darker.

It is not unusual in these designs to employ bright shades of silk for weaves of a rib class, which are so constructed as to show the characteristic qualities of yarns of this material. Moreover, it is almost a general rule to apply the brightest colours to those sections of the design composed of warp cord crossings.

Fig. 166 is a worsted trousering style, and is composed of four weaves, namely, a warp wave, corkscrew warp flushed, corkscrew weft flushed, and of fine twill. But it is not merely the variety of crossings which deserves notice, but also the arrangement or plan of combination. On both sides of the warp wave are bands of weft twill, contrasting with not only the former weave, but the bold stripes of fine twill represented in dots. These latter bands are intervened by

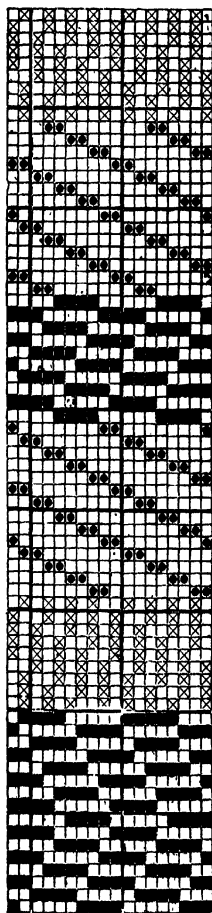


FIG. 166.





FIG. 167.

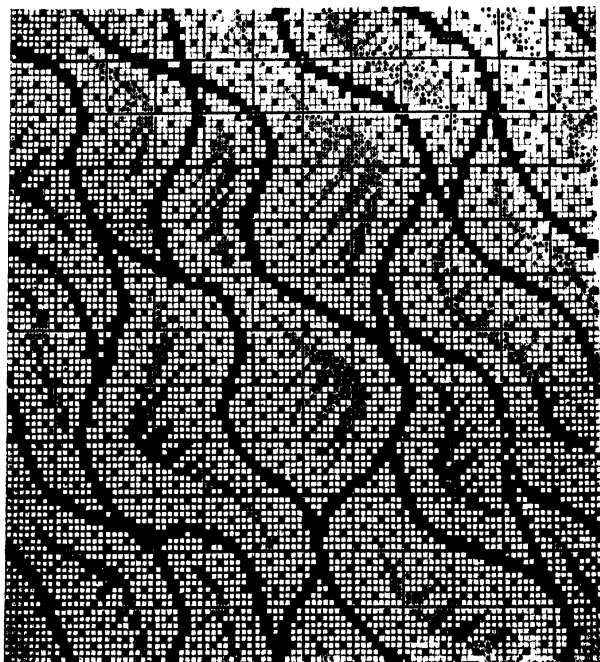


FIG. 167A.



If a dark heliotrope were used in the weft, then the figuring would be woven in such colour upon the striping of white and medium heliotrope.

The design may also be woven in a stripe of a three-colour class. If *D*, Fig. 12, were used, suitable proportions of colours would be :—

40 threads of white.	8 threads of white.
8 „ green.	8 „ pink.
8 „ white.	8 „ white.
8 „ pink.	8 „ green.

If two materials were used, say cotton in the warp and silk in the weft, then white silk would be suitable for the weft; but if the weft is cotton, then a light tone of heliotrope would form a pleasing contrast with the striping in the warp. It is a type of figured designing, economically coloured in the weft, but diversified both as to the degree of contrast of colour, and method of shade assortment or striping in the warp.

## CHAPTER XII.

### SPOTTED EFFECTS.

189. Varieties of Spotted Fabrics—190. Spots due to Specific Systems of Weaving—191. Swansdown Twill Spotted—192. Spots composed of  $\frac{3}{1}$  and  $\frac{1}{3}$  Twills—193. Weave-Spotting produced by both Floats of Warp and Weft—194. Irregular Spotted Stripes and Checks—195. Spots developed by single Extra Warp Threads—196. Fabrics Spotted with Single Picks of Weft—197. Mat Weaves Spotted—198. Corkscrew Weaves with Extra Spotting Picks—199. Spotted Diagonals—200. Warp and Weft Spots compared—201. Spotting in both Warp and Weft—202. Advantages of the Warp and Weft Methods of Spotting—203. Yarns used for Spotting—204. Spotted Effects in Ordinary Weaves—205. Application of Fancy Yarns to Compound Weaves.

189. *Varieties of Spotted Fabrics.*—Woollen, worsted, cotton, and linen fabrics are all more or less ornamented on the spotted principles of designing and colouring. In all cases, it is sought to distribute or arrange, on a tinted groundwork, a series of minute spots, which may be composed of either the same or of distinct shades from those used in the construction of the general surface of the fabric. When this species of pattern is developed in woollens and worsteds, the spotting consists of mere specks of colouring, resulting from the employment of a special scheme of interlacing the warp and weft yarns. Cotton and linen styles require bolder and clearer spots than woollens, and, as a rule, are fuller of effects. There are various points to be considered in the construction of these patterns, relating to the method of development, the plan of grouping, and the dimensions of the spots.

Respecting the method of development, this is subjective to the facilities at command. Thus, if the spotting can only be worked out in those yarns that constitute the ground of the texture, then it is more a matter of inventing a suitable scheme

of weave-design than of any specific process of colouring. But should a special series of warp threads be used for the spotting, then it becomes necessary to utilize both a particular type of weave and order of colours. Generally considered, spotted patterns are of four varieties, as follows:—

- I. Spots developed by the ordinary warp and weft of the fabric.
- II. Spots obtained by using an extra series of warp yarns.
- III. Spots obtained by using an extra series of weft yarns.
- IV. Spots obtained by using both an extra series of warp and weft yarns.

The first is the simplest class of spots. It is due to special

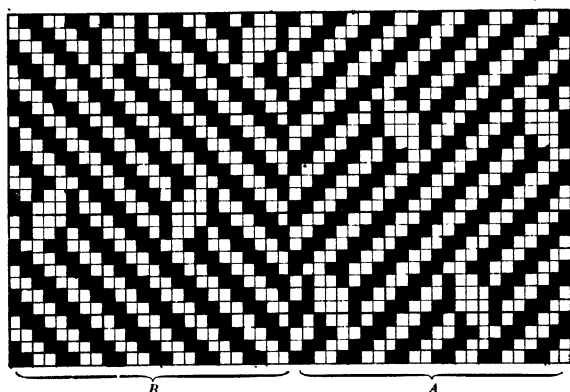


FIG. 168.

schemes of floating the warp, weft, or both these sets of yarns, at regular intervals in constructing the fabric; that is to say, if the construction of the texture were of the mat order, here and there the mat effect would be substituted by groups of warp and weft flushes, lending to the surface of the fabric a spotted aspect. This type of spotted weaving is largely practised in designing for various descriptions of fancy woollens, worsteds, and cottons. In the second, third, and fourth classes of these patterns extra groups of shades, entirely independent of those forming the ground of the texture, are employed. They allow of the production of more intricate effects than those developable by the first system, but are more difficult to manipulate in both weave and colour combinations. Ornamental styles coloured in

the warp for vestings, dresses, robes, and mantlings, also in the weft, and in both warp and weft, are but developments of these forms of weaving and shade-arrangements. Subsequent analyses of these textiles will demonstrate the affinity of the principles of their construction with those of the spotted designs now under consideration.

190. *Spots due to Specific Systems of Weaving.*—As these are purely a product of the plan of building the fabric, they may be designated Weave-Spots. Thus the design given in Fig. 168 would yield a spotted effect, however simple the system of colouring might be. The pattern resulting, Fig. 169, is an example. The shades in this texture are slate and white—the latter being the warp—and the effects consist of small white spots on a twilled surface. Of course in silk and worsted dress fabrics the spots are of various forms, and are arranged on geometrical bases; but in woollens small effects, as in the illustration, are the most appropriate. Still, the principles of this type of designing, whatever the form of the spot and the scheme of distribution, are the



FIG. 169.

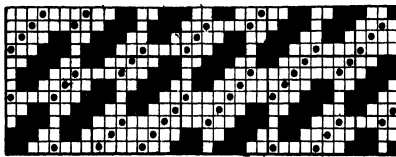


FIG. 170.

same, relating primarily to a diversification of the plan of weaving. In Fig. 168 the twill is interrupted at certain periods, to allow of the formation of a

spot composed of floats of warp yarn of some three threads in width and five picks in length. In Section *A* such spots lean to the right, and in Section *B* to the left, or in both parts of the style they run with the twill. It should be observed that, when modifying a common weave to develop spotted results, care must be exercised not to injure the general build of the fabric, for this is a factor that must always remain intact. As

to the size of the spot, it varies according to the fineness of the fabric and the nature of the pattern to which it is applied.

191. *Swansdown Twill Spotted*.—The spots in this instance are due to the weft yarn. They may consist of small diamonds, minute figures, and other forms, and be arranged in diagonals, twills, or on such a system as to constitute an irregular effect. For example, in Fig. 170 they run in oblique lines, and in Fig. 171 they compose a vertical diagonal. As a rule, the colouring of these styles is of a simple order, merely comprising the employment of neatly - contrasting shades. If any additional shade - effects, besides those yielded by the spots of weft yarn, are required, fancy yarns are introduced into the warp to a limited extent. Take an illustration in colouring Fig. 170,

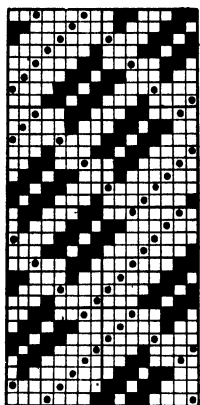


FIG. 171.

in which the yarns are combined to form a striped pattern for cotton dresses :—

<i>Warp.</i>	<i>Weft.</i>
26 threads of medium blue.	All bright medium brown.
2 „ „ slate.	
2 „ „ medium blue.	
2 „ „ white.	
2 „ „ medium blue.	
2 „ „ slate.	

This arrangement gives a pattern consisting of a bold band of medium blue, succeeded by fine lines of slate and white ornamented with spots of bright brown on a warp-twill ground. Now consider Fig. 171 in relation to worsted dress goods. Taking the warp to be a light fawn shade and the weft brown, again a texture results with a twilled surface, but in this instance the ground parts are fawn spotted with brown. It will be apparent from these illustrations that in designs of this class but a small variety of colouring is needed, and that the fancy shades are usually worked into the warp, while the weft, in

order to afford uniform emphasis to the spotting, is of one shade throughout the texture.

192. *Spots composed of  $\frac{3}{1}$  and  $\frac{1}{3}$  Twills.*—The main elements of these styles are the irregular character of the spotting, the uniformity of the weft floats—these never covering more than three threads in succession—and the clearness of the patterns when shades forming a strong contrast are used for warp and weft. They form an extensive series of weave combinations, and examples are given in Figs. 172, 173, 174, 175, and 176. What-

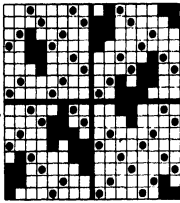


FIG. 172.

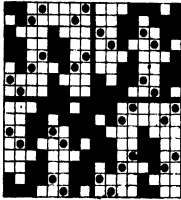


FIG. 174.

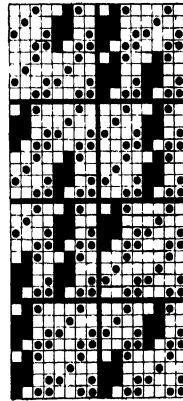


FIG. 173.

ever the weft yarn employed in the manufacture of these textiles, it constitutes, as in the preceding styles, the spotting, while the warp yarns tint the ground of the fabric. Though in these designs the spots generally appear to be irregularly arranged, still, on closer examination, it will be obvious that in the planning of each weave well-defined principles of textural composition are observed. Thus, in Fig. 172 each thread is depressed six times in each repeat of the design; in Fig. 173 sixteen times; and in Figs 174 and 175 eight times. Here, therefore, is one element of uniformity of structure denoting the designing principles in these weaves. This uniformity of interlacing extends to the picks also, hence the designs are essentially

regular in construction, and, with the exception of Fig. 172, yield patterns in which the flushes of warp and weft, are equally balanced. It is needless to observe that this is an all-important

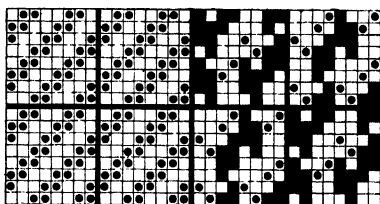


FIG. 175.

characteristic in the build of spotted combinations.

Respecting the schemes of colouring practised here, they are so various that only a few of them may be indicated. First, sup-

pose Fig. 172 were woven in a brown and white twist warp, and crossed with black, slate, or blue weft. The pattern resulting from this arrangement would consist of a brown and white twist ground spotted with minute spots of different shapes of black, slate, or blue, according to the weft yarn used. Fig. 173 produces a more regular cast of pattern than the preceding style. Here an appropriate method of colouring in the warp is two-and-two, while the weft again should be one solid shade. For example, let the warp be 2 threads of slate and 2 threads of medium blue and white twist, and the weft brown, then the pattern would consist of some diversity

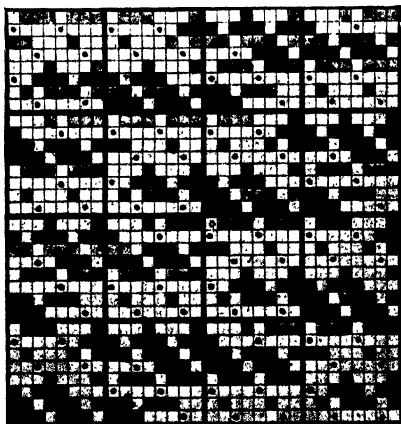


FIG. 176.

of tinting. It is only furnished as an illustration in shade-arrangement, and ought, in practice, to be considerably varied; a fabric would result possessing a brown, slate, and medium blue and white twist ground, spotted with small patches of twist threads and of brown.

A still more irregular plan is given in Fig. 174, by which a

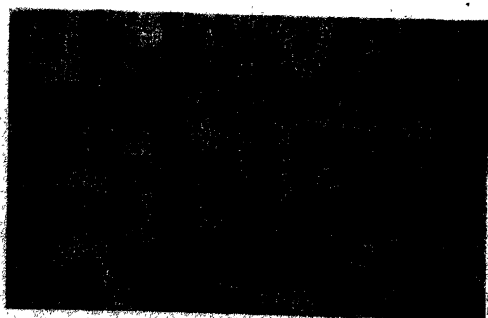
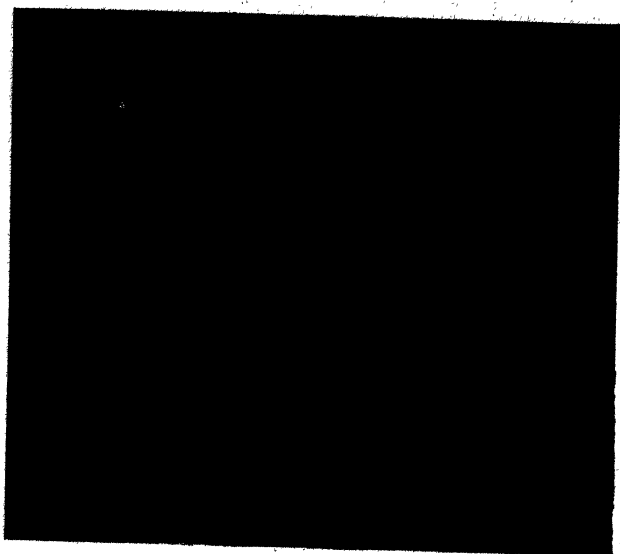


Plate XXVI

**FANCY YARN COLOURINGS**

1. Donegal Thread

2. Compound Wools Worsted





marked intermingled effect is acquired. The warp and weft shades used in this design should slightly contrast, but produce a soft mellow colouring. The pattern may be striped in the warp, 16 threads of medium grey, and 16 threads of light grey, and woven with blue weft.

The shade of blue used should form exactly the same depth of contrast with the light as with the medium grey.

Fig. 175 is of the striped order, for the spotted effect is here combined with a band of sixteen threads of cassimere twill. Any simple method of colouring the twilled section may be practised, because if the scheme of colouring is too elaborate it does not contrast well with the shades forming the latter part of the design. Such a scheme as the one appended is typical of what is usually applied in this class of effects:—

*Warp.*

- 1 thread of black and grey twist.
- 1 „ black and green twist.
- 2 threads of black and grey twist.
- 2 „ brown.
- 1 thread of black and green twist.
- 2 threads of black and grey twist.
- 1 thread of black and green twist.
- 2 threads of brown.
- 2 „ black and grey twist.
- 1 thread of black and green twist.
- 1 „ black and grey twist.
- 16 threads of brown.

*Weft.*

Blue.

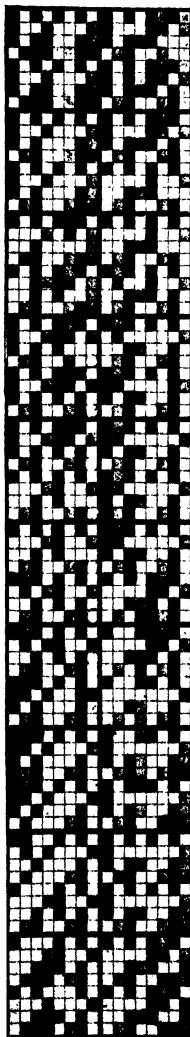


FIG. 177.

The former, or twilled part of the style, would thus be striped  
 • with lines of colour, while the latter part of the design would

be developed in brown and blue, the brown shade composing the ground, and the blue the figured or spotted appearance.

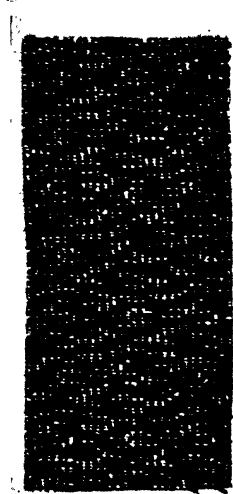


FIG. 177A.

Figs. 176 and 177 are examples in the methods of colouring such weave compounds in the weft, the weaves being grouped to form types of broken figuring. Both patterns are wefted one-and-one, but two-and-two and irregular weftings are also practised, the warp being, in each case, of one shade, but contrasting in colour with the shades used in the weft. Fig. 177 gives the effect seen in Fig. 177A, the warp of which is cotton and the weft fine woollen. Another feature of Fig. 177 is that the floats of weft are increased in order to produce an additional effect in the fabric. This principle of designing and colouring

is applicable to fabrics of a figured character, and may be developed in dress, vesting, and fancy cotton textures.

193. *Weave - Spotting produced by both Floats of Warp and Weft.*—A more elaborate and interesting species of patterns results from this plan of spotting than from that of producing the spots by the warp or weft separately. All the shades entering into the texture now assist in the development of the spotted effects—an element of the designs which increases the diversity of

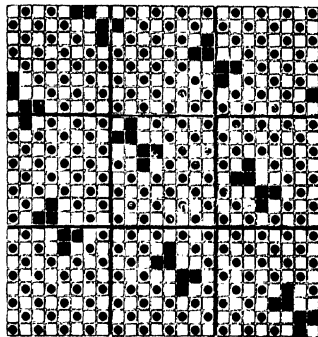


FIG. 178.

colouring and pattern formation feasible. Three very distinct specimens of this scheme of spotting are Figs. 178, 179, and 180. Considering Fig. 178 first, it has a plain ground, the spots being arranged on an eight-shaft sateen base. Such a

design may be coloured on two methods—the warp and weft may be of distinct or of the same shades. Supposing, therefore, that in the first place the warp is of one colour only, such as brown mixture and crossed with blue mixture, then the mingled effects due to the plain ground would be enhanced by the specks of these colours resulting from the spots in the weave marked

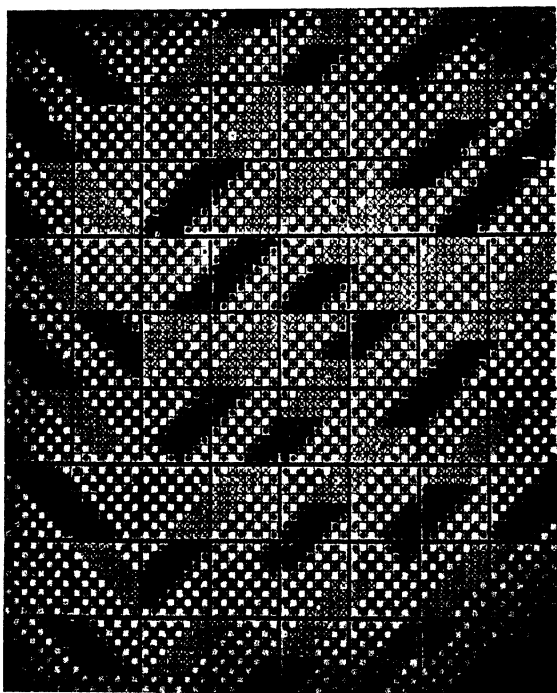


FIG. 179.

□'s and ⊠'s = warp.

◻'s and ■'s = weft.

in full squares. By adopting, in the second instance, the thread-and-thread system of colouring in both warp and weft, a still more diversified style would ensue. In such a case the ground of the fabric consists of vertical lines with slightly indistinct spots at regular intervals. For fabrics in which clear effects are requisite this latter system of colouring is the most appropriate, but in goods where mingled colouring is required the former

scheme of colouring is preferable. Fig. 179 shows how this principle of spotting is applied to designs of a more figured character. Section *A* may be used separately, forming a series of broken twills composed of spots of warp and weft floats alternately. The extended design gives a more varied style of pattern, but the principle is the same. Several schemes of colouring might be practised. First, the Simple orders of shades, such as one-and-one, and two-and-two, woven as warp in the same or different colours, or crossed in the weft: that is to say, one-and-one warping woven with two-and-two wefting, and *vice versa*. Another method is to colour in stripe arrangement in the warp, and to use one shade of weft: the weft spots then form a distinct feature of the pattern. Fig. 180 is a compound of

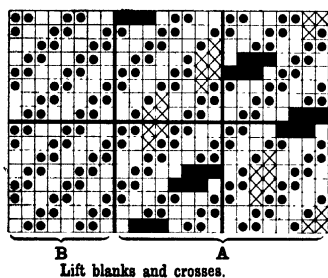


FIG. 180.

Spots {  $\boxtimes$  = warp,  $\square$  = weft.  
 $\blacksquare$  = weft,  $\square$  = warp.

cassimere twill and of a spotted weave. Part *A* is a spotted twill, the spotting comprising both warp and weft flushes, thus securing a proper balance of colouring when fancy yarns are used. The design is capable of modification, both in weave and colouring. For example, if it were worked out on twenty-four threads and twenty-four picks, with the same size of spots,

these would be grouped on a sateen base. Provided a stripe were required, the eight threads of twill, bracketed *B*, might be added. A check, in which the same weave forms the principal factor, is obtainable by surrounding Section *A*, which should be doubled in size, with a band of eight threads and picks of common twill.

A standard method of colouring is:—

#### Warp.

2 threads of medium grey.  
 2 " dark grey.

#### Weft.

1 pick of medium grey.  
 2 picks of dark grey.  
 1 pick of medium grey.

• The small spots developed in the design in  $\boxtimes$ 's by this scheme of colouring consist in the woven sample of dark grey warp,

while the spots developed in ■'s consist of medium grey weft; but as the groundwork of the pattern is a compound of small dark and medium grey checks alternating, the spots would not be pronounced. Another useful method of colouring is as follows:—

<i>Warp.</i>	<i>Weft.</i>
12 threads of brown mixture.	Blue mixture.
1 thread of black and blue twist.	
1 „ black and crimson twist.	
2 threads of brown mixture.	
1 thread of black and crimson twist.	
1 „ black and blue twist.	
6 threads of brown mixture.	

In this instance, the spots marked in the design in ☒'s would, in the texture, be brown mixture, and those in ■'s blue. This arrangement of spotted pattern is also coloured on such principles as to form mixture, check, and other styles.

194. *Irregular Spotted Stripes and Checks.*—These styles constitute a further important type of weave-spotting. Designs constructed on this base are compounds of three weaves. Generally the ground weave is common twill, but it may be also mat or any other crossing which combines well with the twills employed in forming the spotted lines. If the weaves are of the four-shaft class they are generally those combined in Fig. 181. This pattern (see Fig. 182) is a spotted check. The fine warp and weft lines running transversely and longitudinally in the fabrics are of similar dimensions. Thus the effects formed by threads *A* exactly correspond to those formed by picks *A*<sup>1</sup>. In both instances there is one small weft and warp line, and one large weft and warp line. It is a rule for each spotting thread and pick in these designs to be of the same interlacings.

If Fig. 181 is woven in a white warp and dark weft the cassimere twill sections would be a mixture of brown and white twills, while the surface of the texture would be dotted with lines of the respective shades, so grouped as to form indefinite rectangular figuring. Should the picks *A*<sup>1</sup> be changed to common twill, the spotting would only be lengthways of the fabric,

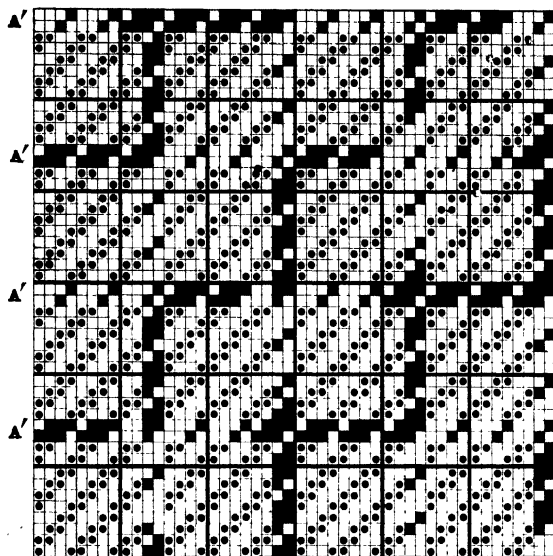


FIG. 181.

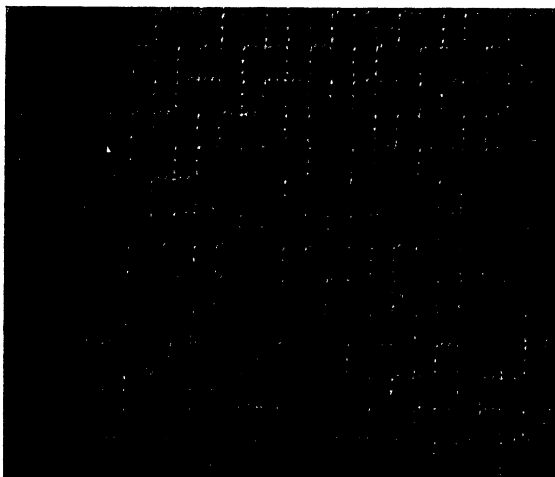


FIG. 182.

illustrating the principle on which the spots are made to produce striped patterns.

There are several methods of colouring practised in this build of design. Firstly, the spotting threads and picks are alone fancy yarns, the intervening threads and picks being composed of solid colours, thus:—

*Warp.*

- 10 threads of medium grey.
- 1 thread of black and green twist.
- 1 „ black and orange twist.

*Weft.*

- 10 picks of dark grey.
- 1 pick of black and blue twist.
- 1 „ black and orange twist.

Secondly, the ground or common twill parts may consist of small checkings, and the spotting threads of bright shades. This scheme is worked out in fancy suitings and dress fabrics. A third arrangement comprises the use of cotton, silk, and worsted yarns, warping and wefting ten dark and two light, as in Fig. 182. This method is varied by using three or more colours for the spotting threads and picks, thus:—

*Warp.*

- 10 threads of white.
- 2 „ light blue.
- 10 „ white.
- 2 „ light brown.
- 10 „ white.
- 2 „ green.

*Weft.*

Same as warp.

195. *Spots developed by Single Extra Warp Threads.*—Patterns of this character are applicable to woollen, worsted, and cotton and silk textures. Differing in construction from the preceding examples, the system provides for the interlacings of a special series of fancy warp yarns in developing the spotted effects. These threads yield a pattern supplementary to that



resulting from the colourings forming the ground of the fabric, and from the twilled or other weaves used in the structure of the cloth. Any plan of weave or system of colouring may be adopted in producing the general foundation of the pattern; for the spotting is obtained by a distinct set of threads, and is controlled by a section of the weaving plan entirely independent of the design giving the cloth proper. As all spots got on this

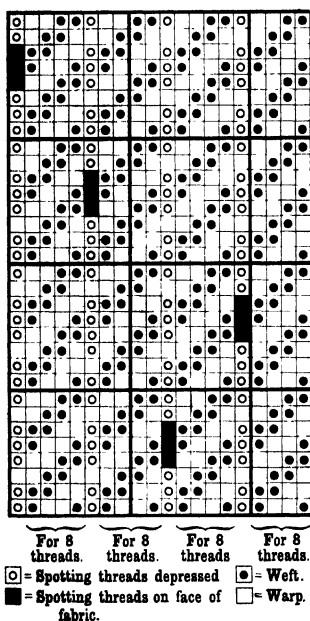
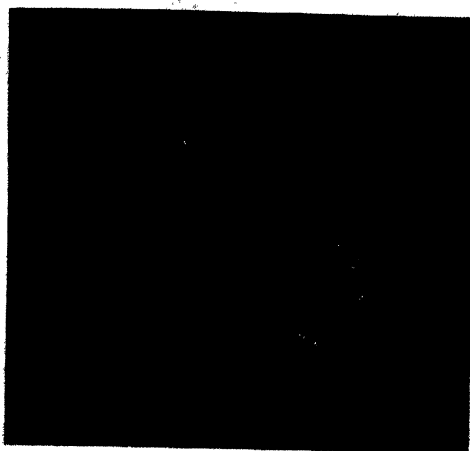


FIG. 183.

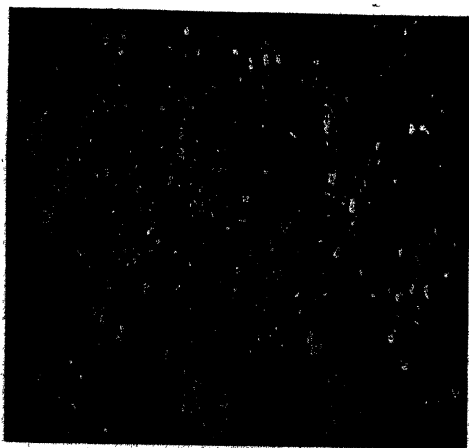
principle are due to the use of a regular yarn, and not to fancy twists of a knop, cloud, or spangle class, the fabric resultant is quite uniform in texture and smooth on the surface. This is a feature the weave method of spotting possesses over the yarn system. Threads of a knop type, though giving the requisite spot, yield a fabric more or less rough in appearance and handle, while the patterns, as regards the spotting, have no definite form or arrangement. On the other hand, in the weave system, the spots may be located or distributed over the face of the fabric according to the effect required. If desirable, the spotting may be arranged to form check, diamond, small figure, and other

designs. Further, there is another difference between these two systems of introducing spots of bright colouring into woven pattern. When fancy twist yarns are used for spotting, the whole design, both ground and weave effects, results from the interlacing of these threads; whereas, in the weave arrangement, the spotting yarns do not constitute the groundwork of the texture, but merely add freshness to the pattern.

Fig. 183 is an illustration in this method of spotting. It will be observed that there are eight threads of twill to one thread of spotting. According to the patterns of warp which are given.



1



2

Plate XXVII

COLOURING WITH CURL AND KNOP YARNS.

1. Twill Weave
2. Small Figure





below, the spotting yarns are much brighter in colour than those forming the ground of the fabric. This is the general rule. The spots appear on the face of the pattern in those positions in the design where they flush over three picks in succession, but run on the back of the texture in all other instances. The spotting ends are so controlled that the small specks of bright colouring they give are arranged on the four-shaft broken swansdown base, and hence are not only regularly distributed, but are also at equal distances from each other in the woven cloth. The groundwork of the pattern is simple in colouring, and forms a species of shaded check.

Two examples in colouring this design are appended :—

*I. Warp.*

1 thread of tan.  
4 threads of black.  
4 „ medium grey.  
1 thread of blue.  
4 threads of light grey.  
4 „ black.  
1 thread of scarlet.  
4 threads of medium grey.  
4 „ light grey.

*II. Warp.*

1 thread of green.  
4 threads of black.  
4 „ brown.  
1 thread of lavender.  
4 threads of medium brown.  
4 „ black.  
1 thread of orange.  
4 threads of brown.  
4 „ medium brown.

*I. Weft.*

4 picks of black.  
4 „ medium grey.  
4 „ light grey.

*II. Weft.*

4 picks of black.  
4 „ brown.  
4 „ medium brown.

196. *Fabrics Spotted by Single Picks of*

*Weft.*—There are various methods of producing weft spots, but they may be grouped under two heads, thus: First, effects in which certain picks of the weave are removed and substituted by special picks that will bring the spotting yarns on to the face

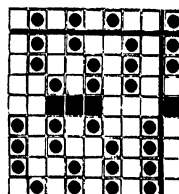


FIG. 184.

of the texture; second, effects in which a special series of spotting picks is employed. The latter system is the one most practised, because it gives the best results and the most uniform style. Fig. 184 is an illustration of the first method. It is a weave with a corkscrew-twill ground, the fifth pick of which has been

changed to the pick marked in squares, which brings the fancy silk pick on to the face. The warp is usually a solid or mixture shade, and the weft the same or a contrasting shade, with the spotting pick in bright colour.

197. *Mat Weaves Spotted*.—One of the most useful methods of spotting with weft is given in Fig. 185. The spotting picks, *A*, appear on the face of the fabric where the full squares are seen. They have been arranged on the eight-shaft sateen base, which ensures an even and regular distribution of the spots. The structure of the design is elementary. It only differs very slightly from the hopsack weave backed with weft. The solid squares ■, are the only features which cause it to possess a different structural appearance from the same weave when backed with the  $\frac{3}{1}$  twill. These marks are, however, sufficient to produce the required spotted effect in the woven cloth, when fancy yarns are introduced into picks *A* of the pattern.

The following are two typical methods of colouring this class of weave. In the first system, the ground of the fabric is one solid colour, but in the second system, it is striped with twist yarns.

*I. Warp.*

Blue or slate mixture worsted.

*I. Weft.*

2 picks of blue or slate mixture worsted.  
1 pick of silk, or worsted and silk twist.

*II. Warp.*

16 threads of brown.  
1 thread of black and scarlet.  
1 „ brown.  
4 threads of black and lavender.  
1 thread of brown.  
1 „ black and scarlet.

*II. Weft.*

2 picks of black.  
1 pick of black, blue, and white silk twist.

198. *Corkscrew Weaves with Extra Spotting Picks*.—The scheme of spotting given in Fig. 186 possesses one advantage over that in Fig. 184—the ground weave or crossing is kept intact. Any weave or combination of weaves may be employed for

forming the texture, and the spots may be distributed on any simple principle. If a fancy effect is required, special spots can be made to form diamond, check, and small figured patterns. The spots are somewhat more distinct than in the previous design, but in this example they have only been arranged to give a very minute dot in the fabric. Should a heavier texture be wanted than it is possible to produce by this single weave, a warp back, as in Fig. 187, may be added. In a single-make

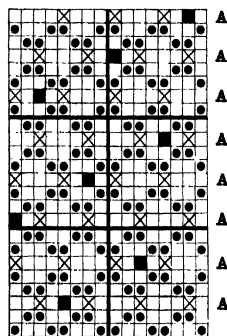


FIG. 185.

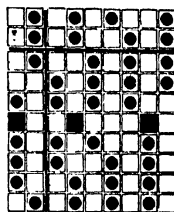


FIG. 186.

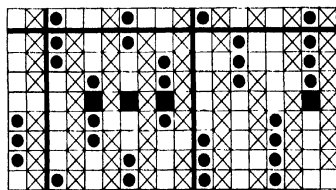


FIG. 187.

fabric it may be woven in one shade of warp and ground weft, with the spotting pick in bright colour.

199. *Spotted Diagonals*.—Fancy diagonals, as well as other types of fancy weaves, are frequently spotted with silk yarns, particularly in the construction of vesting patterns. An example in this class of designing is furnished in Fig. 188, which consists of a twenty-four shaft diagonal composed of corkscrew and ordinary twilled effects.

Here special picks have been inserted for developing the spot. Thus the picks *A*, marked in  $\boxtimes$ 's, produce the spotting. They form a broken twill pattern, two of the spots leaning to the left and two to the right. The weave comprises three distinct effects: first, a solid, compact warp twill; second, a similar twill of weft-flush; and, third, a furrow of corkscrew twill. The warp

colouring might be solid, but the weft should consist of one pick silk and of six picks of worsted.

200. *Warp and Weft Spots compared.*—Probably the method of developing spots by an extra series of warp threads is better adapted to woollens and cottons than to worsteds. In the last style of fabrics silk is the common material used for spotting purposes. Being fine and lustrous, it imparts richness of character to the woven fabric. For several reasons it is preferable to use extra picks in spotting worsteds. Thus the weft principle of spotting allows of considerable latitude for figured

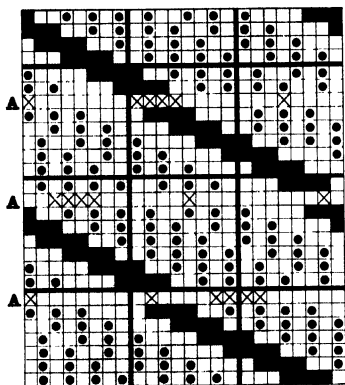


FIG. 188.

work and variety of pattern, and does not largely increase the cost of weaving, nor add materially to the complication of design construction. In spotting worsteds by the warp system with silk, an extra warp or chain beam is required, and an additional set of healds—which multiply the difficulties of the weaving process. Even when these increased facilities are requisitioned, the amount of figuring

feasible is limited; whereas, by the weft method, the spot can be of any form or dimensions. On the other hand, the warp scheme is specially suitable for woollen effects of a tweed order in which colouring is the main element, and where the extra yarns form mere dots of colour on the surface of the texture. Each principle has therefore its specific place in textile designing.

201. *Spotting in both Warp and Weft.*—This principle of design combines the two preceding methods of spotting—making it feasible to spot the surface of the fabric both in the warp and weft. It follows that patterns fuller of effect and richer in spotting are producible by this system. There is, however, one disadvantage in the employment of this method of spotting—it adds to the intricacy of the weaving operation, for special threads and picks are necessary in the production of fabrics.



The spotted twill, Fig. 189, illustrates the plan of arrangement. The twill or ground weave is, in designs of this class, continuous, and forms, independently of the spotting threads and picks, a perfect texture. Further, the spotting is so arranged that it does not interrupt the twilled effect. It is an additional and separate element of the design. When constructing such styles, the order and size of the spots are the two main points for consideration. The methods of grouping the spots are similar in both warp and weft; thus, if there are four threads of ground weave to one thread of spotting in the warp, there will be the same proportion of ground and spotting picks in the weft. Adherence to this rule results in the manufacture of a uniform pattern. Having decided upon the scheme of grouping, say five threads of ground to one thread of spotting, as in Fig. 189, proceed by marking out the spotting threads and picks on point paper in colour, next add the

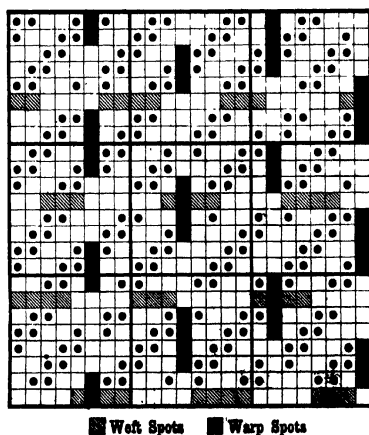


FIG. 189.

ground weave, and, lastly, determine the dimensions and order of the spots. As to the ground, it may consist of any well-planned assortment of twills, mats, or fancy weaves. With regard to the size of the spots, this varies according to the class of the texture being manufactured. For tweed fabrics, small effects are the neatest, but in some types of mantlings, in which the spotting yarn is mohair or lustre worsted, large, clear, and bold spots yield the best patterns. Worsted, linens, and cottons, with silk or mercerized cotton yarns for spotting, are, as a rule, designed with minute, precise, and smart effects. Distribution of the spots is done on numerous systems, such forms of arrangement as the diamond, simple figures, and sateens being used. In

the example, Fig. 189, the spots are grouped on a broken-check base. Three methods of colouring this design require explanation.

### I.—COLOURING FOR COTTONS.

#### \* *Warp and Weft.*

For { 1 thread of tan.  
5 threads. { 1 „ fawn.  
                  1 thread of pale blue (spotting).  
For { 1 thread of fawn.  
5 threads. { 1 „ tan.  
                  1 thread of rose pink.

### II.—COLOURING FOR WORSTED SUITINGS.

#### \* *Warp and Weft.*

5 threads of dark blue mixture.  
1 thread of black worsted and green silk twist.  
5 threads of dark blue mixture.  
1 thread of black worsted and russet silk twist.

### III.—COLOURING FOR WOOLLENS.

#### \* *Warp and Weft.*

4 threads of black.  
1 thread of dark blue  
1 „ dark brown and green.  
3 threads of dark blue.  
2 „ black.  
1 thread of black and tan.  
2 threads of black.  
3 „ blue.  
1 thread of dark brown and green.  
1 „ dark blue.  
4 threads of black.  
1 thread of black and tan.  
4 threads of dark blue.  
1 thread of black.  
1 „ dark brown and green.

\* In each case, the order of picking must correspond with the order of the spotting picks, in the designs.

- 3 threads of black.
- 2 „ dark blue.
- 1 thread of black and tan.
- 2 threads of dark blue.
- 3 „ black.
- 1 thread of dark brown and green.
- 1 „ black.
- 4 threads of dark blue.
- 1 thread of black and tan.

In the first colouring, the ground of the fabric is a composition of tan and fawn grouped on the thread-and-thread system, the spotting yarns being pale blue and rose pink. The second scheme is for textures consisting of one solid shade in the ground; the surface of the fabric in this instance is dark blue mixture, having the check spotting produced by the weave—Fig. 189—in fancy worsted and silk twists. The third arrangement is a simple four-and-four check composed of black and blue, the spots falling in different parts of the checks. Should it be necessary to have the spotting always in the centre of the four threads, the construction of the design would have to be modified. Instead of the arrangement being five threads of ground to one thread of spotting, it would require to be four threads of ground to one thread of spotting.

202. *Advantages of the Warp and Weft Method of Spotting.*—In all fabrics in which spotting is the chief characteristic, the warp and weft principle of design construction is the most effective. Mantlings of a matelasse order, worsted dress textures, fancy cottons for vestings and quiltings, are all spotted by this method. Allowing, as it does, for the employment of a double series of spotting yarns, it yields patterns characterized by much diversity of tinting and intermingled effects. By causing the two sets of spotting threads to interlace with each other, and arranging for them to be of different colours, patterns full of textural details are produced. Still, for ordinary suiting fabrics either the warp or weft method is generally practised, because in these textiles the spotting yarns are only intended to dot the surface of the fabric with minute specks of bright colouring, and not to form decided patterns, as in mantling and dress styles.

203. *Yarns used for Spotting.*—The yarns used for spotting purposes are of various types. All classes of fancy threads, including knop yarns produced in carding, but single in construction, and twists or folded yarns of various types are used.

The first type is that employed in the production of Donegal tweeds, where the yarns are single, but coloured knops or specks are formed at intervals on the thread. These are due to distributing on the material, during carding, neps of fibrous material of different colours, which enter into the condensed sliver and become part of the spun thread. By this method the position of the colour on the thread is not mechanically controlled, but the selection of the neps of fibres used for spotting determines the harmony of colour result in the woven fabric. There must first be a suitable blend of ground colour obtained in the carding of the material, and this having been fixed, the strength and blend of colour for nepping purposes is arranged. No Donegal pattern would be satisfactory in colour quality—which is the chief design characteristic such fabrics possess — unless the nepping colours gave strength and character of contrast to the ground colouring, as seen in No. 1, Plate XXVI.

Some of the fancy and folded threads used for similar purposes as knop carded yarns, are those illustrated in Plate XXV., comprising 3-ply, cloud, knop produced in twisting, curl, and gimp yarns. Yarns *A*, *B*, and *C* are ordinary threefold twists, being composed thus: *A*, black and scarlet worsteds, and salmon silk; *B*, black and green worsteds, and salmon silk; *C*, black, russet, and orange. For spotted worsteds, there are few yarns so useful as this class of worsted and silk twists. Samples *D*, *E*, *F*, *G*, and *H* are cloud threads. They are chiefly used in fancy tweeds. As a rule, they are rich in colouring. Threads *D*, *E*, *G*, and *H* are analogous in construction, for they are all composed of four colours and have one thread, which may be termed the central or principal yarn, all other threads twisting or twining round it. The composition of these respective twists is as follows:—

*D.* Black for the central thread or shade, and crimson, green, and blue for the intermittent colours.

*E.* Grey for the central thread or shade, and scarlet, black, and tan for the intermittent colours.



**Plate XXVIII**

**COSTUME COLOURING IN FANCY YARNS**



*G.* Dark olive for the central thread or shade, and blue, yellow, and light olive for the intermittent colours.

*F.* Light drab for the central thread or shade, and black, scarlet, and tan for the intermittent colours.

Obviously, the result of using such yarns is to spot the surface of the texture with the various tints entering into their composition.

Threads *F*, being of several thicknesses, differ in construction from threads *D*, *E*, *G*, and *H*. Still, this type of thread gives effects in the fabric somewhat resembling those resulting from the yarns with which it is grouped, and is also designated a "cloud" or "flock." It is, however, less complex in colouring, and forms an elongated spot in the texture.

The curled yarns are illustrated in types *I*, *J*, and *K*. Three examples are given—slate, crimson, and fawn. The curls or loops are of different sizes. Such threads are applied to both woollen and worsted fabrics, but mainly to tweeds and fancy costumes. They give to the pattern a richly-tinted aspect. Some classes of trimmings may be made entirely of these threads, but their relation to spotted fabrics is here alone considered.

Gimp and knop twists are also employed largely in designs of a spot class. Five illustrations of these are given in samples *L*, *M*, *N*, *O*, and *P* on Plate XXV. These threads are generally only applied to the more fancy designs. Yarn *L* is a composition of three threads—black, blue, and tan. The black and blue form a two-ply twist to which the tan is added in the twisting operation. Small knops, causing the yarn to be somewhat irregular in thickness, are formed at intervals by the tan thread. Compound *M* is more irregular in colouring and construction. Loose in twine, and of various thickness, it gives a novel type of spot, but on account of the lack of adhesiveness in its composition it is a difficult thread to manipulate in weaving, and hence is but sparingly employed. Yarn *N* is a real gimp. Two black threads, well tensioned in twisting, have been combined with yellow and crimson threads of slack twist, and running loosely. Thread *O* is similarly constructed to *N*, only the gimp is not so prominent, owing to the several colours being more evenly tensioned during twisting. Compound *P* is 'a

combination of gimp and knop. Thus knops or buttons of tan colour—see *a*—are formed at intervals on the thread. Yarns *N*, *O*, and *P* are suitable twists for spotted goods of various descriptions.

204. *Spotted Effects in Ordinary Weaves*.—The several classes of spotted patterns analyzed have all resulted from the employment of special builds of weaves. There are, however, some important species of these effects obtained in designs constructed on the ordinary principles of intertexture, which are extensively developed in both plain and ornamental fabrics. Allusion will now be made to several types of these patterns. It may be observed that in producing the spotting in these styles the fancy twists described in the preceding paragraph are utilized. Pattern No. 1 on Plate XXVII. is a specimen of fancy tweed spotted by this method. The cloth is woven from a twelve-end twill, the weft being black, and the order of warping as appended:—

- 2 threads of dark blue.
- 1 thread of black and tan curl.
- 2 threads of dark brown.
- 1 thread of black, brown, and white small curl.
- 2 threads of dark grey.
- 1 thread of black and blue curl.

It is scarcely necessary to observe that the curled yarns are the main elements of this colouring, spotting the fabric with small loops of tan, blue, and white. Knop, cloud, and gimp threads are similarly introduced into fancy fabrics. The effect of the knop twist is seen in the next illustration—Pattern No. 2, Plate XXVII. The minute figuring is due to combining two broken crow weaves. It is a style of design for union mantlings, and is capable of being varied to an unlimited extent in both colouring and ornament. The warp is entirely composed of brown and white knop cotton twist. The dots of white noticed in the texture are a product of the warp yarns, and not of any peculiarity in the structure of the weave or design. Such an irregularly spotted combination as this sample is only producible by yarns of the knop and cloud kind.



A third example, full of colour elements, No. 1, Plate XXVIII., may be described. It has been designed for a fancy coloured costume in the plain weave, and is illustrative of the variety of effect producible by order of warping and wefting, and diversity of yarn structure in which hues, tints, and shades of colours are used. The yarns are of six varieties, *A*, *B*, *C*, *D*, *E*, and *F*, being composed of two or more colours, and all different in construction. *A* is a pronounced knop yarn; *B* a curl yarn, of four varieties of colour, namely, deep crimson, orange, pale orange, and green; *C* shows the difference in thickness and in wavy effect possible in gimp yarns; *D*, irregular twist with knops of fibres; *E* and *F*, more ordinary twists, slack and hard spun intermittently. These, when arranged as in the fabric to make a check pattern, with over-checking in green, make a groundwork of colour which can only be acquired in textiles by using diversity of yarn structure. Blending in the material, or distributing colour in the weave, as in the spotted designs, Nos. 168 to 180, all repeat the colour regularly or in a prescribed pattern; but when the yarns are so diversified in construction, the colours are, as seen in the fabric, not selected on any definite method.

205. *Application of Fancy Yarns to Compound Weaves.*—Only two examples need be considered here, as the character of the results is similar to that of those obtained in single weave fabrics; only by reversing the position of the threads in the warp and weft, a prescribed form of pattern, see Plate XXIX., may be produced. On this principle, any type of design, as to figure or form, may be constructed, but it will have the same varied tinting as single weave fabrics, in which similar yarns are used. In this design, fancy knops and other cotton twists have been used. These yarns give the spots of lavender, tan, and scarlet, which are regularly distributed throughout the pattern. It is a double-weave structure arranged one thread ground, one thread of fancy yarn, and one thread of ground.

A different example produced in worsted yarns, and worsted and cotton twists, is that given in No. 2, Plate XXVI. It is double in structure, arranged one thread ground, and one thread fancy yarn, and not two-and-one, as the style on Plate XXIX. The ground yarn is a single thread, forming the plain portions of the

fabric, the curled yarn being in dark crimson, heliotrope, orange, and pale orange. A certain simple outline of pattern is formed by reversing the face and backing yarns. It is a good blend of colour, in which there is contrast of hue between the heliotrope and orange, and contrast of tone between the crimson and heliotrope; but the chief characteristic is the diversity of colour surface due to the curl or loop twist yarns, and the way in which the colours in consequence of their arrangement are softened in quality.

## CHAPTER XIII.

### COLOURING OF DOUBLE WEAVES AND REVERSIBLES.<sup>1</sup>

206. Principles of Double Cloth Colouring—207. Styles of Colour Effects obtained in Double Weaves—208. Double Plains—209. Classification of Double Plain Stripes—210. Double Plain Stripes in Two Shades—211. Two-Shade Stripes Warped Irregularly—212. Styles in Three Colours—213. Double Plains combined with other Weaves—214. Intermingled Double Plain Compounds—215. Reversibles—216. Methods of Colouring Double Plain Reversibles—217. Colouring of Figured Designs containing Double Plain and other Weaves—218. Reversibles arranged Two-and-One—219. Figured Compound Weave Patterns—220. Compound Colourings in Compound Weaves—221. Colouring of Double Cloths, such as Golf Cloakings and Rugs.

206. *Principles of Double Cloth Colouring.*—As briefly indicated in Chapter V., the general principles of colouring fabrics of a backed and double-make structure, resemble those applied to single textures. Particularly is this the case when the fabrics are the ordinary types of trousering, coating, and suiting styles. This follows from the fact that the face of these cloths largely consists of patterns of similar composition to those produced in single textiles. Still there are some builds of backed fabrics, which, owing to being coloured on both surfaces, involve the employment of two distinct schemes of colouring—one for each side of the fabric. The object to be attained in such fabrics is the development on the under side of the texture of a pattern that will, in general tone and character, correspond with that appearing on the face; but, though this species of colouring on the back is frequently necessary, inasmuch as it enhances the selling qualities of the fabric, yet the grouping of the face shades is the primary consideration, for it must be in accordance with

<sup>1</sup> For information on the principles of designing double-make fabrics, the reader is referred to *Woollen and Worsted Cloth Manufacture*.

the weave-compound used in the construction of the cloth, whereas the scheme of colouring applied to the back is of secondary importance, and should be made to coincide in its main outlines with the style of colouring composing the face of the texture. An example may be analyzed. Fig. 163 is a weave-combination, which it is required to back with warp and colour on such lines as to obtain a stripe style of pattern on the under surface. The face order of colouring is given on page 261, and has already been treated of. Without describing the structure of this build of backed fabric, it may be stated that the arrangement is generally one thread of face weave and one thread of backing throughout the design. It is usual to plan the backing warp according to the composition of the face design, so that the following scheme would, in this instance, be appropriate:—

30 threads of light mixture.	30 threads of light mixture.
14 „ medium mixture.	6 „ slatish blue.

This would result in the production of an effect in colouring on the back of Fig. 163 quite in keeping with the scheme applied to the face, though the exact order of the face warping is not followed. The simpler the arrangement of shades on the back the better, so long as it conforms with the order of colours producing the pattern on the face side.

Another method of duplicate colouring in double and backed cloths, consists in having any ordinary scheme on the back which comprises a number of threads that is a multiple of the number occupied by the face pattern. Thus, in the scheme of colours for the design considered, Fig. 163, there are eighty threads, hence arrangements comprising twenty, forty, and eighty threads might be utilized. These are divisible into two or four stripes, according to the style of effect required on the back of the texture. In this kind of colouring it is evident that the combination of face shades is not closely worked to—a stripe neat in colour composition being the main factor for development.

When the yarns for the face and back of the fabric are of the same size and material, it is a rule in making out the pattern of

warp to combine the two schemes of colouring, but each scheme is necessarily designed separately. In fabrics backed on the warp principle, it is feasible to have patterns of a striped character on the under surface, while if the fabric is backed with weft, colouring on the back results in striping the texture transversely; it is, therefore, only by employing the double-cloth method that all forms of colour effects may be developed on both sides of the fabric.

207. *Styles of Colour Effects obtained in Double Weaves.*—

While, as is evident from the brief definitions of the principles of double-cloth colouring furnished in the preceding paragraph, the application of fancy shades to the ordinary groups of double weaves is more or less analogous to their application to single weaves and compound designs, yet there are some builds of double cloths which produce specific styles of patterns, such as are not obtainable in other descriptions of weaving and schemes of colouring. Amongst the most useful of these types are the double-plain, the double-cassimere, the double-mat, and combinations of these weaves. Patterns obtained in these makes, cover a large diversity of styles for trouserings, coatings, suitings, mantlings, shawls, rugs, curtains, and carpets. Here, however, the plan of colouring is not usually elaborate, being adapted to the structure of the design. The main characteristic of these fabrics which distinguishes them from effects obtained in single-make designs is the firmness and strength of the cloth, combined with clearness and precision of ornament or pattern. The utility of this class of design is evident in the varieties of textures, in which patterns are products of the double-weave system of cloth construction. As the structure of the weave is uniform in the fabrics mentioned, there are certain principles of colouring applicable to each class of effects. But, generally speaking, the use of a new double-weave necessitates the practice of a distinct system of colouring.

208. *Double Plains.*—For giving variety of effect and pattern, there is no class of double make more useful than the double plain. The analyses made in Chapter VIII. of the schemes of colouring used in the single weave make it evident what are the common principles of gaining effect by combining fancy shades

in double plain; and, moreover, what is the type of pattern here producible; for, as the system of interlacing, is still plain—one fabric being formed above or over the other—whatever pattern is workable in the single weave may, by duplicating the plan of colouring, be also obtained in the double weave. Bearing this principle in mind, the methods of pattern development in double-weave designs of all classes will be readily understood.

The simplest type of effects developed in this structure of weave is stripe patterns. It includes fabrics of two, three, and four shades. As a rule, the shades combined are of a mellow and subdued character, being more in keeping with the build of the fabric than bright shades. Still, in fine worsted and cotton textures, somewhat brighter shades are employed than in woollen fabrics, which, being usually felted, mainly consist of patterns resulting from combining toned colours. These stripes may be of any dimensions, from line-like effects to broad bands several inches in width. Next to stripe patterns in importance are intermingled patterns. Such styles possess a peculiar diversity of minute effects, which makes them readily distinguishable from the mingled patterns obtained in other weaves and methods of colouring. Some of these effects will be analyzed. Checks, diagonals, small figured styles, and elaborately-ornamented textiles, are also developed in these weaves. All these fabrics are double plain throughout. Though the weave is apparently an unimportant factor, yet it is closely related to the pattern produced, and has moreover to be modified with every change effected in the outline and form of the design resultant. Strictly speaking, all double plain patterns are composed of at least two weaves—one of which brings the odd series of yarns on to the face, and the other the even series. It follows that if a cloth is warped and woven one-and-one—say black and white—that one make gives a black, and the other a white effect on the face of the fabric. Remembering this principle, it will be evident how, by changing these weaves in working out figured or ornamental patterns, any construction of design may be acquired.

209. *Classification of Double Plain Stripes.*—Striped designs,



Plate XXIX

REVERSIBLE KNOP-TWIST YARN PATTERN





obtainable by colouring double plain designs according to various systems, are as follows:—

- I. Patterns in two shades.
- II. Patterns in three shades.
- III. Patterns in four shades.
- IV. Patterns in two, three, or four shades, comprising double plain and other weaves.

The most elementary form of pattern obtained in the double plain is the "hairline." It resembles in appearance the effect produced by warping and wefting the single plain make thread-and-thread, only the fabric is sounder and firmer in build, as well as finer and more compact in construction. This simple style is a product of a certain method of colouring the double plain, but the same weave can be arranged and coloured to yield an endless variety of patterns.

Three-shade stripes are, on the average, richer in colouring than the first order of patterns, and include the most useful forms and builds of double plain stripes. The third class, while composed of a larger number of shades, lacks scope for diversity of arrangement. As to the patterns comprised in the fourth class, they are rarely composed of more than two shades, but owing to containing additional weave elements they are more diversified in design.

210. *Double Plain Stripes in Two Shades.*—These are of two types: I. Patterns warped and woven one-and-one; and II. Patterns coloured variously, but in strict accordance with the structure of the design used. Allusion will primarily be made to the I. type of these styles. In this form of pattern, it is a question of arranging the double plain weaves on such principles as to produce any style of stripe pattern. Take an illustration. Patterns 1 and 2 on Plate XXX. are double plain stripes obtained by this method. The colourings are as follows:—

1.	2.
1 thread of olive.	1 thread of brown.
1     "      slate.	1     "      brown and white twist.

The feature for analysis is, how the various combinations of  
• stripes, and in Pattern 2 of twilling, are developed in these

textures, which are composed solely of double plain weaves. Pattern 1 is an assortment of small stripes of four different sizes worked out in two shades. If necessary, the design—i.e. the plan of weave—could be so modified as to give a pattern in which the stripes would not only run from a broad to a narrow band, but tone off on both sides. A brief analysis of the design for this texture, given in Fig. 190, will make it evident what the principles of weaving are, which determine the construction of this kind of pattern. Here two double plain makes are combined, one of which floats the odd, and the other the even threads and picks on the face. Now these weaves are so grouped in this design that they give a pattern corresponding in every detail with No. 1 on Plate XXX. The use of these two weaves, and the method of adjustment, are two elements of design to which all such styles of woven effects are due. The weave marked in grey is the reverse of that marked in dots, for it brings the even set of threads on to the face, while the weave,  $\square$ , takes them on to the back. When it is considered that the arrangement of colouring is one slate and one olive, and that each of these weaves forms two fabrics one over the other, it becomes obvious that in Sections *A* of the design (Fig. 190) a slate stripe of plain fabric will cover an olive stripe of similar dimensions; but in Sections *B* a plain olive band conceals a corresponding stripe of slate. Referring to Fig. 191, which is the weave arrangement for producing Pattern 2 of Plate XXX., it will be observed that it is a style containing, in addition to the stripe effects, a series of clear twills. Evidently these have been developed on the same system as the preceding example, which consists of the identical weaves and order of colouring as Fig. 191. Diversity of pattern has, therefore, been acquired by adopting a different method of combining the weaves. This is effected by first sketching out on point paper the exact form of the pattern required, and then adding weave *A* of Fig. 190 to the uncoloured parts, and weave *B* to the coloured sections. It will be subsequently shown that reversible double plain styles are but developments of this species of designing.

211. *Two-Shade Stripes Warped Irregularly*.—First, there are styles of this class which are compositions of two shades, and

in which variety of pattern is only producible by ingenious methods of grouping fancy yarns. By the aid of two examples (Patterns 1 and 2, Plate XXXI.) it may, however, be shown that even when thus limited to the use of two colours a considerable



FIG. 190.

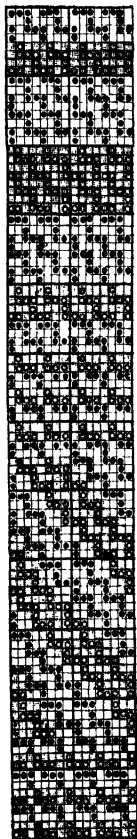


FIG. 191.

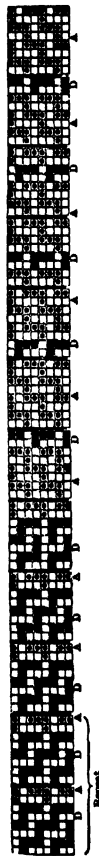


FIG. 192.

range of patterns may be acquired. The order of shades for Pattern 1—the design for which is given in Fig. 192—is:—

<i>Warp.</i>		<i>Weft.</i>	
For	{ 6 threads of slate.	1 pick of slate.	
54 threads.	{ 2 „ black.	1 „ black.	
For	{ 8 threads of black.		
58 threads.	{ 2 „ slate.		

One principle that requires to be taken cognizance of in making double plain stripes is, that while only every other thread comes on to the face, every pick, to some extent, is useful in forming the pattern on the right side of the fabric. As the principal feature of such styles is the solidity of the several lines of colour, providing these do not exceed four in number, it becomes a problem of so constructing the design that each shade of weft used, shall only float or flush over that colour of warp yarn it is supposed to match. To produce a stripe in two colours is comparatively simple; but, in the example given in Pattern 2 on Plate XXXI., the difficulty of arranging the plan of weave is increased by varying the order and size of the lines of colour. Thus, there are bands of colour of eight, six, and two threads each, or, on the face, of four, three, and one thread respectively. If the design, Fig. 192, is examined, it will be observed that the odd picks only cover the face-threads in parts *D*, which are the slate threads in the fabric, while the even picks are arranged to cover the face-threads in part *A* only. Should the weave be further dissected, it will also be noticed that picks 1, 3, 5, and 7 interlace plain with the face-threads of *D*, but that picks 2, 4, 6, and 8 interlace plain with the face-threads of sections *A*. In this manner, the solidity of each stripe of colour, which is the essential feature of such styles, is kept intact, and a pattern formed possessing distinctness of parts. This example, and No. 1 of Plate XXXI., illustrate the numerous effects producible in these weaves by this method of colouring. Both parts *A* and *B* of Pattern 1 form stripe arrangements. By varying the number of bands of these respective combinations, useful species of pattern are producible. Pattern No. 2 shows how a broad band of one shade may be worked into the texture, and then a line-like stripe of a second shade formed upon it.

There is one peculiarity about the weave-design—Fig. 193—forming the drab band in Pattern 2 of this Plate, which contains eighteen threads. The ordinary double plain used in Figs. 190, 191, and 192 is untied; it follows that if some sixteen or more threads were used, as in this instance, the woven pattern would be loose and unsatisfactory in structure. So long as no more than eight threads form a stripe, tying may not be necessary; but when

this number is exceeded, a weave must be employed that, while tied or stitched, will not interfere with the neatness, compactness, and uniformity of this type of woven colouring. The weave generally used for this purpose is given in part *A* of Fig. 193. Though somewhat irregular in construction, it produces a fabric perfectly even on both surfaces, and as smart and clear in other respects as the double plain texture. The order of colouring for this example is: *Warp*, 18 threads of drab, 2 threads of brown; and *weft*, 1 pick of brown and 3 picks of drab. The drab picks never float over the face-ends of brown, and, on the other hand, the brown picks always float under the drab face-ends—this being the principle of intertexture to which the solidity of the respective lines of colour is due.

212. *Styles in Three or more Colours.*—Some extremely

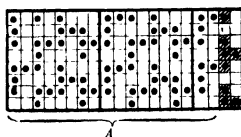


FIG. 193.

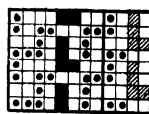


FIG. 194.

interesting and effective stripes are got in double plain weaves by employing three and four colours. Two examples—Patterns 3 and 4 on Plate XXXI.—are furnished in styles composed of three shades. The weave for producing the former (Fig. 194) is simple, being so constructed as to form lines of lavender, claret brown, lavender and white. By comparing the order of colouring—which is given below—with the weave, the principles of design in which the pattern is obtained are obvious:—

<i>Warp.</i>	<i>Weft.</i>
4 threads of lavender.	1 pick of lavender.
2 „ claret brown.	1 „ stained white.
4 „ lavender.	1 „ lavender.
2 „ stained white.	1 „ claret brown.

It will be noticed that the first pick is lavender; the reason for this is, that in the design the face-thread of lavender is down, and if it were covered by any other colour but its match in

shade, the solidity of the lavender line would be interrupted. Pattern 4 of this Plate contains the same number of colour elements, but is quite different in arrangement. The design for this style—Fig. 195—is so planned as to yield an effect, on the face of the fabric, as follows: a stripe of four threads of claret brown and white twist, a fine line of lavender, a stripe of four

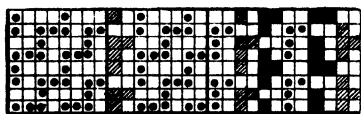


FIG. 195.

threads of claret brown and white twist, a fine line of lavender, a fine line of claret brown, a fine line of twist, a fine line of claret, and a fine line of lavender; in other words, it forms a compound of eight separate bands of colour. The plans of warping and wefting are appended:—

*Warp.*

8	threads of claret brown and white twist.
2	„ lavender.
8	„ claret brown and white twist.
2	„ lavender.
2	„ claret.
2	„ claret brown and white twist.
2	„ claret.
2	„ lavender.

*Weft.*

1	pick of claret brown and white twist.
1	„ lavender.
1	„ claret brown and white twist.
1	„ claret.

The effects in four shades are somewhat limited in variety, the respective stripes being of a single-thread character on the face. They are constructed on the same lines as the three-coloured patterns just described.

213. *Double Plains combined with Other Weaves.*—Patterns of this class are made in worsted, woollen and cotton yarns. Certain weaves of a warp flush character, including types of corkscrews, combine satisfactorily with this double plain. The twills or makes used should be capable of forming neat patterns

when coloured on the one-and-one system, which is the invariable method of wefting such designs. Referring to Fig. 196, which is a weave compound of this description, stripes of double plain are united with a stripe of corkscrew, resulting in the construction of the style given in Pattern 3 on Plate XXX. The colours are maroon and dark green, and are grouped on the end-and-end system in both warp and weft; hence the solid lines of these shades in the double plain parts, and the oblique twills of maroon and green in the corkscrew sections of the fabric. Practically there are two points to consider in the selection of weaves for combining with double plain crossings, namely, the wefting capacity of the crossing, *i.e.*, its power to weave regularly with the plain; and, second, its structure in regard to the scheme of shade-assortment practised in these designs. Respecting the first point, if another double make should be used, such as

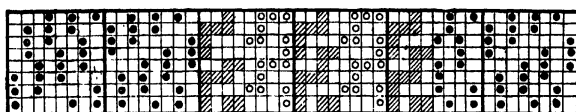


FIG. 196.

cassimere or mat for face, and plain for back, there would **not** be much liability to form a fabric lacking regularity of construction and hence evenness of surface; but, should the **additional weaves** be single in construction, they must be exactly of such **structure** as to work uniformly with the double plain. One point that may be noted in designing for these combinations, is to frequently divide the pattern, and so avoid the formation of broad bands of the several weaves. Then, as to the structure of the crossings in respect to colouring. Warp twills and warp weaves are most suitable, because they do not exhibit the weft colouring to any marked degree, and hence they allow of quite a distinct method of tinting being introduced in the warp of the sections of the design in which they occur.

Styles of this description are neat in form and colouring. Being characterized by smartness of composition and richness of textural effects, they are developed to a large extent.

214. *Intermingled Double Plain Compounds.*—The most

uncommon effects producible in double plain crossings are possibly those resulting from employing schemes of colouring containing an odd number of threads, such as 2, 1, 1 and 1, and

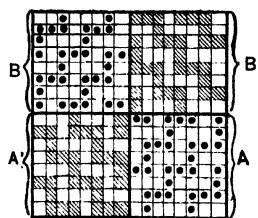


FIG. 197.

the 4, 1, 1 and 1 groupings. The weave used in such schemes of combining shades is given in Fig. 197. In larger styles, sections *A* and *B* are increased to sixteen threads and picks each. By the aid of an example the principles underlying this form of pattern construction may be expounded. Pattern 5, Plate XXXI., results from the following arrangement of colours and the weave, Fig. 197 :-

*Warp and Weft.*

For 42 threads.	{	4 threads of brown.
		1 thread of black and white twist.
		1 „ brown.
		1 „ white.
For 14 threads.	{	4 threads of brown.
		1 thread of black and white twist.
		1 „ brown.
		1 „ orange silk.

The pattern is weavable on eight shafts, one repeat containing 112 threads, so that it possesses the leading characteristics of a Jacquard design. The dimensions of each repeat of the pattern are due to the order of grouping the colours, combined with the weave. Thus, as there are fifty-six threads in each repeat of the colourings before the plan of weaving coincides with the order of the shades, the pattern of warp must run through two, and the weave through sixteen repetitions. The cause of the construction of this pattern consists in the appropriation of a system of colouring, containing a number of threads not a multiple of the number of ends and picks in the weave. This scheme of colouring is practised in fine worsteds and woollens for mantlings, in medium counts of yarns for suitings, and also in linen and cotton textures for vestings.





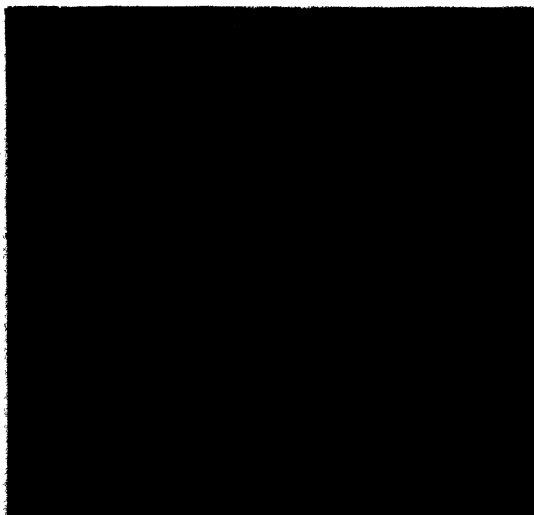
1



2



3



4

Plate XXX  
DOUBLE-PLAIN STYLES  
1. 2. 3. Stripe Patterns  
1. Figured Shawl



There is practically no limit to the variety of effects obtained on this system of colouring double plain designs. On the diamond base, forming Pattern 5 of Plate XXXI., an indistinct check in orange silk is distinguishable; and in this plan of weave and by irregular orders of colouring, many varieties of spotting, intermingled checkings, and other effects in minute and in clear, bold patterns, are produced in various counts of both woollen and worsted yarns. The 2 black, 1 twist, 1 grey, and 1 twist, method of colouring is also useful for this purpose, yielding a form of pattern that can be diversified by modifications in colouring.

215. *Reversibles*.—Double and treble weaves are employed in the construction of these effects. Amongst the compound weaves used for this purpose, the double plain is one of the most important. It gives a species of figuring as clearly developed on one side of the texture as on the other. The system of colouring is mainly one-and-one, with some slight modification, such as a stripe or check effect in addition to the ornamental details worked out in colour. This principle of weaving is practised in the decoration of woollen and worsted shawls and rugs, tapestries, curtains, and Kidder and Scotch and other carpets. In the examples given in No. 4, Plate XXX., and Nos. 1 and 2, Plate XXXII., two builds of fabrics are represented, namely, the double plain and the double twill. An important element of all such figuring, distinguishing it from that obtained by other schemes of weaving, is the clearness with which the details and component parts of the design are developed. This characteristic is a product of the double-weave arrangement. Taking, for instance, the shades of a texture thus constructed to be black and white, it follows that from any double-make combination in which the figuring is produced by changing the positions of the weaves, that is, by transferring that weave on to the back which has appeared on the face, and *vice versa*, there must result a pattern clear in outline and general composition. No other principle of weaving is capable of giving effects so well pronounced in these features: other figured styles are more or less wanting in precision and regularity of outline. Reversibles are made in double weaves arranged on the one-and-one, the two-and-one, and the three-and-one principles. The first method is the most frequently

practised. When the second and third schemes are adopted, the yarns used are of two sizes—that forming the figure being considerably thicker than that employed for the ground of the texture.

216. *Methods of Colouring Double Plain Reversibles.*—Generally these are not very intricate, the main work in ornamenting such fabrics consisting in the adoption of a well-arranged design, with the various sections of the figuring correctly represented on point paper. A few illustrations may be described.

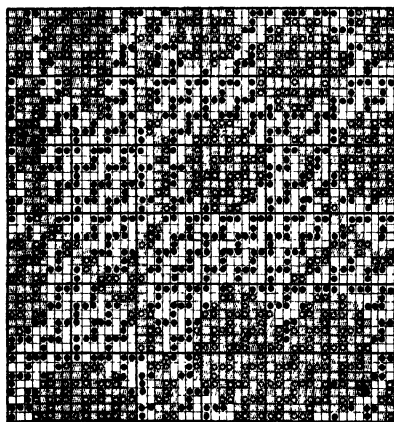


FIG. 198.

On Plate XXX., Pattern 4, and on Plate XXXII., are textures for dressing-gowns and shawls. Sections of each design are given in Figs. 198, 199, and 201. It should be observed that in executing these styles the first work relates to sketching the pattern on point paper, the weaves being subsequently added. The ground sections are occupied by the opposite

weave to that applied to the figured parts. There should not be figure outlines requiring less than two threads and picks to develop, or the effect in the woven fabric will not be satisfactory. It should be considered in preparing these designs that practically every other thread and pick are duplicate yarns—both the odd and even threads not being utilized simultaneously in the construction of the pattern on the face of the cloth. Providing the figure has been correctly worked out on point paper, an appropriate scheme of colouring has then to be applied. Here various technical details and other points have to be considered, such as the structure of the design, whether bold or subdued colouring is the most suitable, and the scheme of grouping shades necessary to develop the ornamental forms of the style. First, the shades of yarn are arranged, one-and-one, throughout, in order to

meet the structure of the double plain weaves. Second, it may be useful to consider types in which the designs are clearly pronounced in every detail, and others in which the figuring is more or less subdued. Take, for example, the worsted shawl pattern, No. 4 on Plate XXX. By warping and wefting thus :—

$$96 \left\{ \begin{array}{l} 1 \text{ thread dark shade,} \\ 1 \text{ „ blue,} \end{array} \right. \quad 96 \left\{ \begin{array}{l} 1 \text{ thread dark shade,} \\ 1 \text{ „ white,} \end{array} \right.$$

the figuring on the face of the fabric is developed in the dark shade, and the ground in the white and blue, the effects on the under side being exactly the reverse of those on the face. For shawls few principles of design are more useful than this, for it gives a texture in every particular as neatly ornamented and constructed on one surface as the other. The border of these goods generally consists of a different pattern from the centre or groundwork of the shawl, and is also differently coloured. Take the following as an example :—

1 thread of dark brown.	}	For	} 192 threads—the edge of the shawl.
1 „ blue.	}	96	
1 thread of dark brown.	}	For	
1 „ white.	}	96	
1 thread of blue.	}	24	} Border — repeat; 768 threads in border.
1 „ white.	}	24	
1 thread of scarlet.	}	24	
1 „ white.	}	24	
1 thread of blue.	}	24	
1 „ white.	}	24	
1 thread of orange.	}	24	
1 „ white.	}	24	
1 thread of blue.	}	192	
1 „ white.	}	192	
1 thread of orange.	}	24	
1 „ white.	}	24	
1 thread of blue.	}	24	
1 „ white.	}	24	
1 thread of scarlet.	}	24	
1 „ white.	}	24	
1 thread of blue.	}	24	
1 „ white.	}	24	

1 thread of dark brown.	} For } 3648 threads—centre of the shawl.
1 „ blue.	
1 thread of dark brown.	
1 „ white.	
	96
Repeat the border.	
„ edge.	

The above arrangement is for a fine worsted shawl made of about twofold fifty's yarns and set in twenty's reed four's. The

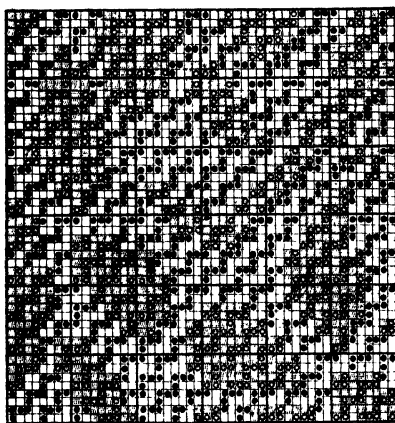


FIG. 199.  
(Section only.)

centre and edges of the shawl are simple in colouring, but the border consists of checks of blue, scarlet, and orange on a white groundwork. As the white yarns alternate with each of these colours, the figuring on one side of the shawl in the border is solid white on the checks named, but on the reverse side the figuring is developed in the

various colours, while the ground is white. Other and simpler forms of colouring besides this are adopted; for instance, another appropriate method of colouring the border and the centre of the shawl, Pattern 4 of Plate XXX., using a double-plain diagonal weave for the edges, is thus:—

1 end of white.	} 96
1 „ light grey.	
1 end of white.	} 96
1 „ dark grey.	

When this class of designing and colouring is executed in woollen yarns for rugs, the fabrics are covered with pile on both surfaces, causing the colourings to possess a very mellow aspect. Pattern 1 on Plate XXXII. is an example of this kind. The



1



2



3



4



5

# Plate XXXI

## VARIOUS DOUBLE PLAIN DESIGNS

1. Warped and Wadded one-and-one
2. 3. 4. System of Warp Colouring Coinciding with the Weave Construct
5. Irregular Warp and Weft Colouring





design (Fig. 199) is made on the same system as that for the preceding style. The arrangement of shades is as follows:—

*Warp.*

- |                           |   |     |
|---------------------------|---|-----|
| 1 thread of dark grey.    | } | For |
| 1 „ white.                |   |     |
| } 48 threads.             |   |     |
| • 1 thread of light grey. | } | For |
| 1 „ white.                |   |     |
| } 48 threads.             |   |     |

*Weft.*

- |                      |   |     |
|----------------------|---|-----|
| 1 pick of dark grey. | } | For |
| 1 „ white.           |   |     |
| } 48 picks.          |   |     |
| 1 pick of brown.     | } | For |
| 1 „ white.           |   |     |
| } 48 picks.          |   |     |

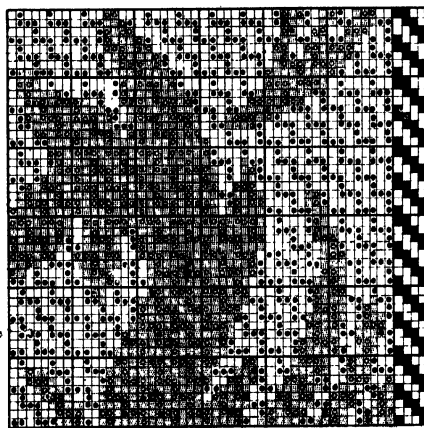


FIG. 200.

217. *Colouring of Figured Designs containing Double Plain and other Weaves.*—One illustration in this type of fabric will show the principles of colouring and weaving which have now to be considered. The object is to obtain three or more effects in figured fabrics mainly composed of double plain crossings, and at the same time to develop with special emphasis the ornamental forms combined. A feature to be avoided in the construction of these designs is the employment of such quantities of the single weaves as will result in the production of a fabric irregular in build. Fig. 200 shows the manner of combining the different

crossings to obtain such effects. Intricate orders of colouring are feasible here, providing the thread-and-thread scheme is retained: the more ingenious the system of grouping the shades, the more valuable the results.

218. *Reversibles arranged Two-and-One*.—This type of textiles is produced in various kinds of yarns, such as worsted, woollen, fancy cottons, and mohair. It is a useful build of fabric, being

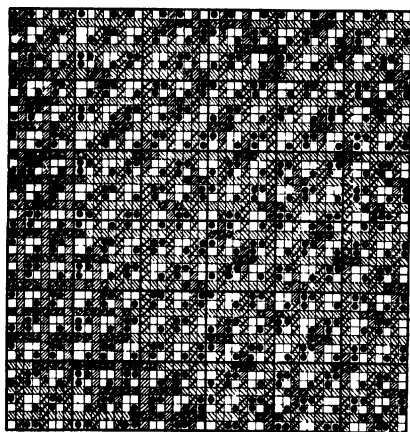


FIG. 201.

□ = Weft in ground.      □ = Warp in ground.  
 ⊞ = Weft figure.      ⊞ = Warp figure.

developed in dresses, suitings, mantlings, vestings, and quiltings. An example in cottons is given on Plate XXIX. A section of the design used in producing this fabric is Fig. 201, from which it is evident there are two ends and picks of ground weave to one end and pick of figure. The weave applied to the ground may be plain, twill, mat, or any other simple crossing, but that applied to the figuring threads is invariably plain in order to secure a texture quite fast in build throughout. The following is the method of colouring practised here :—

- 1 thread of fine white cotton.
- 1     „   thick white cotton twisted with scarlet (knop).
- 2 threads of fine white cotton.
- 1 thread of thick white cotton twisted with lavender (knop).
- 2 threads of fine white cotton.
- 1 thread of thick white cotton twisted with tan (knop).
- 1     „   fine white cotton.

When the following scheme of shades is adopted, the aspect of the design is completely changed :—

1 thread of fine medium blue cotton.

1 „ thick white „

1 „ fine medium blue „

This latter order gives a solid blue ground with a clear figure.

There are several distinct methods of colouring these designs. First, the figuring threads, as in the first of these examples, are coloured variously, while the ground threads are of one shade. This affords a clear development of the design, particularly when the ground and figuring yarns are of contrasting shades. The production by such arrangements of a monotonous groundwork is obviated by spotting here and there with the figuring yarns, as in the patterns on Plates VII. and XXIX. A second system admits of the ground being composed of stripes or checks of any dimensions over which the figuring in bright colourings is distributed. Third, for woollen vestings, to which this type of design in simple twill and spotted effects may be applied, such orders of colouring as are given below being practised :—

#### I.

1 thread of black.

1 „ black and blue twist.

2 threads of brown.

1 thread of black and light olive twist.

•2 threads of blue.

1 thread of black and scarlet twist.

1 „ black.

#### II.

1 thread of light grey.

1 „ black and white twist. } For  
1 „ light grey. } 9 threads.

1 thread of dark grey.

1 „ black and white twist. } For  
1 „ dark grey. } 9 threads.

The ground shades in the first method should be of similar depths of hue, while the twists must not only harmonize with them but also with each other. The checks of light and dark

grey in the second example may, in practice, be of different sizes. One feature of this system is that the groundwork may be varied in colour composition, but the twist yarns making the small ornamental effects suitable for fancy coatings, are of the same shade in both sections of the pattern.

219. *Figured Compound Weave Patterns.*—In general colouring these are treated on similar principles to reversible double plains—such duplicate schemes of shades as are workable in the single weaves being employed. Double cassimeres are coloured on such various methods as to be used in the manufacture of

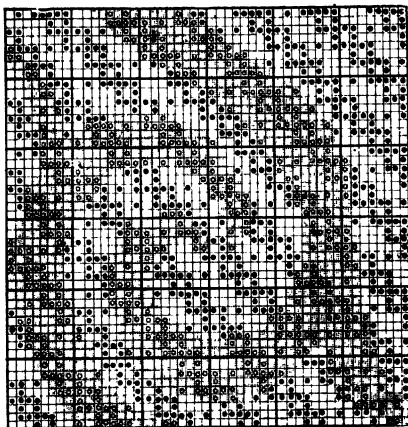


Fig. 202.

plain and figured textures. From Fig. 202, which is a plan of the weaves for the curve effect seen in Pattern 2, Plate XXXII., it will be apparent how the designs are constructed. It is the same weave which is run on to the ground as on to the figure, only in the former the odd threads appear on the face, and in the latter they appear on the back,

while the even threads come on to the face. The order of warping and wefting is one thread of blue and one thread of stained white, so that the structure of the weave-design produces the ground of the texture in blue, and the figure is stained white. The opposite effect obtains on the reverse side of the fabric from that represented in the illustration, the colours which form the ground on one side composing the figure on the other.

220. *Compound Colourings in Compound Weaves.*—This is a good principle of colouring for vesting styles, either in woollen or worsted yarns. Some diversity of yarn structure is used, that is to say, woollen combined with worsted, or with worsted

and silk, in order to obtain a difference in brightness of surface in the texture. No. 1, Plate XXXIII., is an example. The ground colouring is one-and-one in a double cassimere twill; and by reversing, the square spots in the illustration are developed in other methods of colourings which harmonize with the thread-and-thread order. A section of the design is given in Fig. 203, showing how the reversing is effected. This brings on to the face in one portion of the design the two-and-two colouring, and

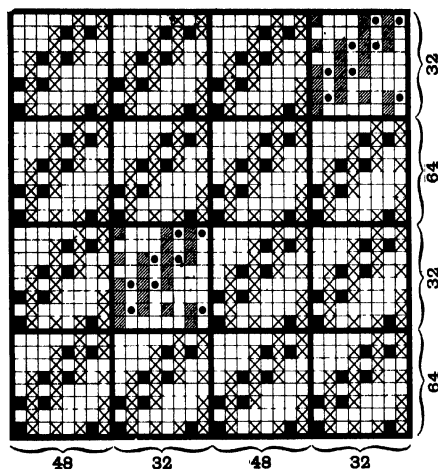




FIG. 203.

 Sections in which the colours are reversed from  
 back to face of the texture.

in another part of the design the four-and-four colouring. Other compound arrangements may be used.

The method of designing consists in arranging, first, the face warp and weft, usually in some simple order of colouring; and, second, a compound scheme for the back, of two or more simple orders of colouring, which, by combining reversible double weaves, may interchange with the face to give the style required. In addition, it is usual in such patterns to colour the face to form either a stripe or a check, irrespective of the special design or pattern due to reversing the backing scheme of colourings to the face, as shown in No. 1, Plate XXXIII. In this pattern, for example, the face colouring is as follows:—

*Face Warp.*

For 24.  $\left\{ \begin{array}{l} 1 \text{ thread of white woollen.} \\ 1 \quad \text{,,} \quad \text{dark grey woollen.} \end{array} \right.$

For 16.  $\left\{ \begin{array}{l} 1 \text{ thread of white silk.} \\ 1 \quad \text{,,} \quad \text{dark grey woollen.} \end{array} \right.$

For 24.  $\left\{ \begin{array}{l} 1 \text{ thread of white woollen.} \\ 1 \quad \text{,,} \quad \text{dark grey woollen.} \end{array} \right.$

For 16.  $\left\{ \begin{array}{l} 1 \text{ thread of white silk.} \\ 1 \quad \text{,,} \quad \text{green worsted.} \end{array} \right.$

*Face Weft.*

For 32.  $\left\{ \begin{array}{l} 1 \text{ thread of medium grey woollen.} \\ 1 \quad \text{,,} \quad \text{white woollen.} \end{array} \right.$

For 16.  $\left\{ \begin{array}{l} 1 \text{ thread of medium grey woollen.} \\ 1 \quad \text{,,} \quad \text{white silk.} \end{array} \right.$

For 32.  $\left\{ \begin{array}{l} 1 \text{ thread of medium grey woollen.} \\ 1 \quad \text{,,} \quad \text{white woollen.} \end{array} \right.$

For 16.  $\left\{ \begin{array}{l} 1 \text{ thread of white silk.} \\ 1 \quad \text{,,} \quad \text{olive brown worsted.} \end{array} \right.$

One colour thus alternates with the white woollen and white silk, and, in the last portion, the white silk alternates with the green worsted warp and olive brown weft.

The backing warp and weft are:—

*Warp.*

For 24.  $\left\{ \begin{array}{l} 1 \text{ thread of white woollen.} \\ 1 \quad \text{,,} \quad \text{dark grey woollen.} \end{array} \right.$

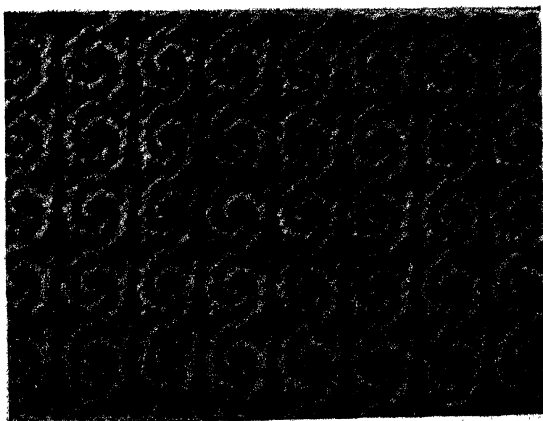
For 16.  $\left\{ \begin{array}{l} 2 \text{ threads of white woollen.} \\ 2 \quad \text{,,} \quad \text{dark grey woollen.} \end{array} \right.$

For 24.  $\left\{ \begin{array}{l} 1 \text{ thread of white woollen.} \\ 1 \quad \text{,,} \quad \text{dark grey woollen.} \end{array} \right.$

For 16.  $\left\{ \begin{array}{l} 4 \text{ threads of white woollen.} \\ 4 \quad \text{,,} \quad \text{dark grey woollen.} \end{array} \right.$



1



2

Plate XXXII

REVERSIBLE DOUBLE-WEAVE FABRICS

1. Double-plain; Velvet Finish
2. Double-twill





*Weft.*

For 32.	{	1 thread of medium grey woollen.
	{	1 „ white woollen.
For 16.	{	2 threads of medium grey woollen.
	{	2 „ white woollen.
For 32.	{	1 thread of medium grey woollen.
	{	1 „ white woollen.
For 16.	{	4 threads of medium grey woollen.
	{	4 „ white woollen.

Or three simple orders of colouring, either the two-and-two or four-and-four being brought on to the face to form the squares.

221. *Colouring of Double Cloths, such as Golf Cloakings and Rugs.*—These are compound in structure, so that a different scheme of colour may be employed for the face from the back of the fabric. It is not, as in the preceding example, a question of reversing the position of the colours, but of confining one scheme of colour arrangement to each side of the fabric. In Pattern 2, Plate XXXIII., the face side is one colour, khaki, and the under-side a tartan check; but, as seen from Fig. 205 (weave 205A), both sides of the fabric may be coloured variously. This applies both to the ordinary golf cloaking or wrap, and to double-weave rugs, where the material, as well as the colouring, may be different on the face and the back of the texture: but in the example on Plate XXXIII., the weave, Fig. 204, is of a special structure in order to produce on the face side a sateen warp effect, in which the colouring for the back does not penetrate on to the face, nor the face colouring penetrate on to the back. The weave for the under-side is  $\frac{2}{2}$  twill, suitable to the development of such colouring. The scheme of colouring for the backing warp and weft is as follows:—

*Backing Warp.*

Red . . .	60	—	60	—	—	—	—	—	—
Black . . .	8	8	60	4	4	—	4	4	60
Blue . . .	12	—	—	—	—	—	—	—	—
Blue green . . .	—	—	12	12	48	48	12	12	—
Yellow . . .	—	—	—	—	12	—	—	—	—

<i>Backing Weft.</i>										
Red . . . .	56	—	56	—	—	—	7	—	—	—
Black . . . .	8	8	64	4	4	—	4	4	64	—
Blue . . . .	12	—	—	—	—	—	—	—	—	—
Blue green . .	—	—	12	12	42	42	12	12	—	—
Yellow . . . .	—	—	—	—	12	—	—	—	—	—

The weft is similar in colouring but the number of picks is not the same as the threads of warp. The colour compound forming the check consists of red, black, blue, blue green, and yellow, the method of finishing the fabric having toned the colours into each other, and softened or mellowed the style of the check. The difference between the effect on the face

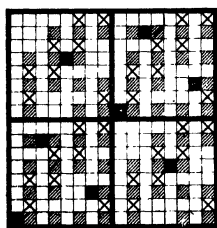


FIG. 204.

■ = Face weave.  
 ⊠ = Backing weave.

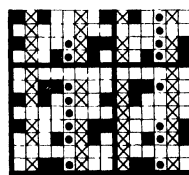


FIG. 205A.

■ = Face weave.  
 ⊠ = Backing weave.  
 ⊙ = Centre-warp stitching.

and on the back is here extreme, but it serves to illustrate how distinct in colour quality each side of such a fabric may be, by employing a suitable weave and counts of yarn.

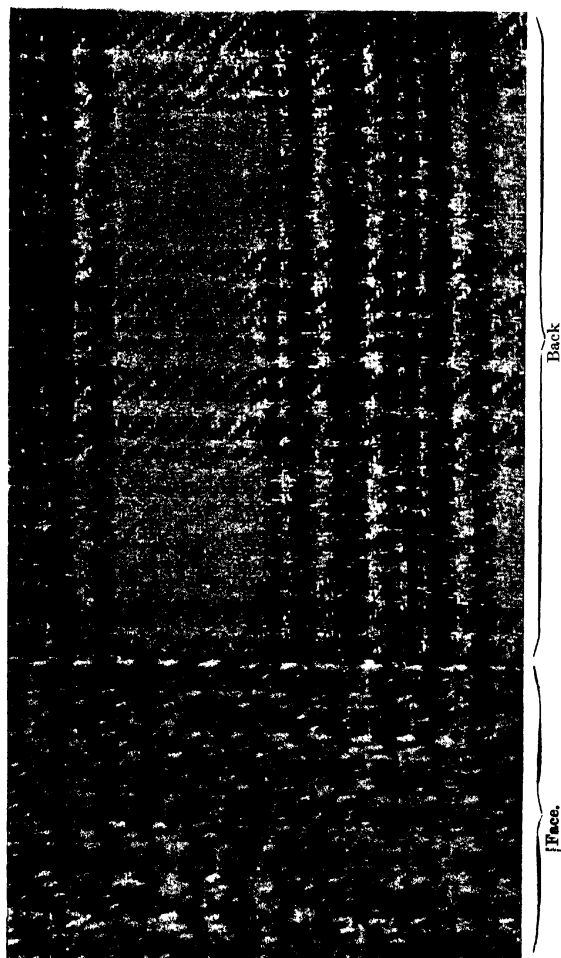
The method of colouring Fig. 205, produced in Fig. 205A, is as follows:—

*Face Warp.*

3 threads of heliotrope and white twist.  
 6 „ brown and white twist.

*Face Weft.*

3 threads of brown and white twist.  
 2 „ „ fawn „  
 2 „ „ white „  
 2 „ „ fawn „.



Back

FIG. 205.

Face.

*Backing Warp and Weft.*

30 threads of white woollen.

2	„	brown and white twist.
2	„	white woollen.
2	„	brown and white twist.
2	„	dark olive and white twist.
4	„	white woollen.
4	„	brown and white twist.
2	„	dark olive and white twist.
4	„	white woollen.
2	„	dark olive and white twist.
2	„	white woollen.
2	„	dark olive and white twist.
2	„	white woollen.
4	„	dark olive and white twist.
4	„	white woollen.
4	„	brown and white twist.

Contrasts in form of pattern—on the face and back of the cloth respectively—as in this example, are applied to golf cloakings and rugs, in stripe and check combinations.

## CHAPTER XIV.

### FIGURED TEXTILES COLOURED IN THE WARP.

222. Methods of Colouring Figured Fabrics—223. Special Elements of Ornamental Woven Design—224. Art and Technique—225. Styles of Figured Fabrics Coloured in the Warp—226. Cotton Quilting Fabrics—227. Ornamental Characteristics of Quilting Designs—228. Attributes of Plush Fabrics—229. Origin of Velvet Weaving—230. Velvets, Compound in Structure—231. Two Classes of Plush Fabrics—232. Warp Plushes—233. Methods of securing the Pile—234. Analysis of the Process of Velvet or Warp Plush Weaving—235. Colouring of Warp Plushes and Figured Velvets—236. Brussels and Tapestry Carpets compared—237. How the Pattern is developed in Brussels—238. Structure of Pile Carpets.

222. *Methods of Colouring Figured Fabrics.*—There are three distinct systems of colouring figured textiles—namely, colouring in the warp, colouring in the weft, and colouring in both warp and weft. According to the first method, the fancy shades are introduced into the warp only—the weft being of one colour throughout the texture. This scheme of colouring is practised in various types of mantlings and dress fabrics, also pile textures of a figured velvet and plush class, and Brussels, tapestry, and velvet pile carpets. Each additional colour in these styles of woven productions may involve the use of a separate set of warp yarns, which, as will be indicated, materially increases the complications of manufacture. Turning to the second system of colouring named, which also obtains in certain descriptions of dress textiles, and in vestings, rugs, and matelasses, it necessitates the employment of several groups of weft threads of different colours. On comparing these two distinct schemes, it may be observed that while the former relates to the utilization of various warp shades—which multiplies the difficulties of weaving in two ways, first, by requiring a Jacquard

of large figuring capacity; and, second, by increasing the diversity of the warp colouring—the latter relates to the employment of various groups of weft yarns, which add to the complexity of production by increasing the number of cards necessary in the construction of the design, and by making the use of a number of shuttles a necessity. Lastly, the third method is a combination of the arrangements just considered, and is applicable to similar fabrics. It is, for obvious reasons, the most complex system of colouring, and is only feasible in looms specially constructed and mounted for the weaving of figured fabrics, comprising both warp and weft colouring in a considerable diversity of shades.

223. *Special Elements of Ornamental Woven Design.*—Woven design requires distinct treatment from other species of decoration; it is not simply surface ornamentation, for it also relates to the production of a suitable fabric for developing the details of the pattern. Every description of textile designing has, in a word, a two-fold relation, for it is both utilitarian and ornamental. Primarily, it relates to the construction of a texture uniform in surface and of the requisite quality and strength; and, secondly, it relates to the decoration of the fabric. Ornament in woven structures is inseparable from the weave which produces it. Consequently, it cannot be applied with the same facility to a textile surface as to paper-hangings, porcelain, etc. In these instances, the designer's work consists in the embellishment of an article obtained by a distinct process of manufacture; whereas, in textiles, warp and weft are the elements out of which both the pattern and the fabric are evolved. Design or ornament and texture have by these agents to be developed simultaneously. Instead of manipulating straight and curved lines in the formation of the pattern, threads of warp and weft have to be interlaced on such methods as to constitute the design required. In order to develop the integral parts of woven design, by imparting appropriate prominence to certain sections and subordinating others, a knowledge of the structure of textile fabrics in general is indispensable. Elaborate textile designing is only perfect so far as the various figures and details of the ornament are clearly defined in weaving.

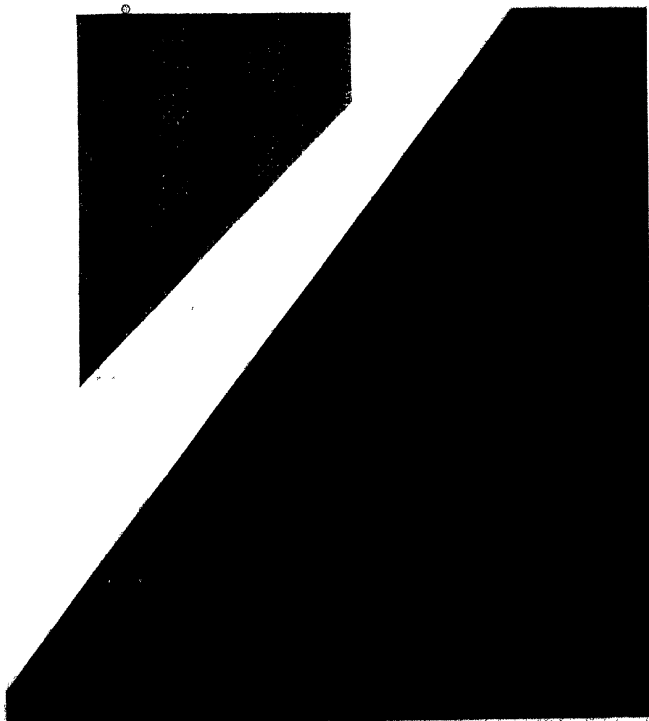


Plate XXXIII

1. VESTING

2. REVERSIBLE GOLF CLOAKING



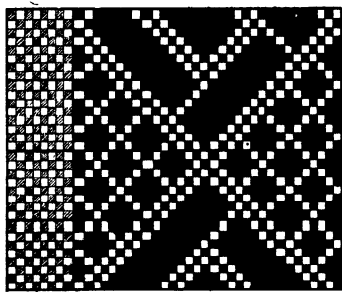


The correct delineation of the objects, and evenly-balanced grouping and distribution of figure, chiefly affect the artistic phases of the subject. Textile pattern is too frequently marred by defective and faulty development. Either the materials used are unsuitable for displaying the characteristics of the style, or the designer has only partially understood the work. With the form and general conception of the design there is no fault to be found, but with the manner in which it has been executed.

224. *Art and Technique*.—It will be obvious from the preceding paragraph that technical dexterity in textile designing is the power of developing, with appropriate emphasis, all types of ornamental effects, whether in relation to form or colour, with the construction of a fabric uniform in texture and soundly built. Technology relates primarily to weaving, but in an ampler sense to the invention and combination of schemes of crossings calculated to add novelty and uniqueness to woven design. Technical or weave patterns provide, however, infinite diversity of texture. It may be ribbed, furrowed, twilled, diagonalled, or covered with pile. Weave design is the feature of the ornamentation of some types of silk patterns (see Fig. 232). Of course it is materially enhanced by artistic elements of form and colour, for technique and art are, in these fabrics, essential to each other. In all woven decoration, art is the natural and requisite associate of technique. Technique determines the strength and fineness of the fabric; art determines its ornamental force and symmetry of the design. Technique regulates the distribution of materials; art appoints the forms, groups the figures, and blends the colours.

225. *Styles of Figured Fabrics Coloured in the Warp*.—The simplest type of figured textures coloured on the warp principle is essentially single in construction. There is no duplicate series of yarns for colouring purposes, but a special set of threads used in certain sections of the ground warp of the fabric. Pattern 1 on Plate XXXIV. illustrates this scheme of colouring. From this example and the section supplied of the design in its production—Fig. 206—it is apparent that the texture is constructed on the single-weave principle, the only irregularity, consisting in a number of threads—white in the pattern—being

flushed or floated on the surface of the fabric to form the figure in stripes *A*, *B*, *C*, and *D*. The weft effect is therefore concealed in these sections of the texture. In warp matelasses, the same principles of weaving and colouring obtain—the weft yarns acting as binding agents, and not appearing on the face in the figuring, unless a special set of weft yarns is employed, as in some styles of matelasse vestings, spotted with bright colours. This description of warp effect is, however, a compound fabric,



Part 4 of Pattern 1, Plate XXXIV.

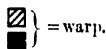


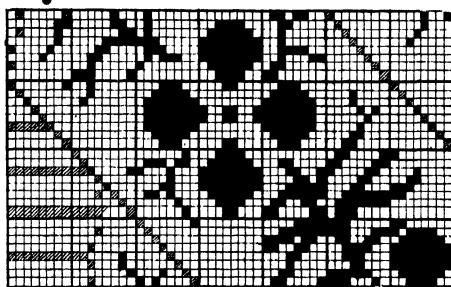
FIG. 206.

possessing two warps and two wefts, and may be arranged two threads of figuring to one thread of ground in the warp, but one-and-one in the weft. The ground warp is invariably cotton, but the figuring warp is worsted, silk, or mohair. One weft is thick cotton or wool, and is used for wadding or for giving fulness and clearness to the design, and the other is fine cotton, worsted, or

silk, according to the quality of fabric produced. Not infrequently, an additional woollen weft is employed for backing.

Quite a distinct scheme of warp colouring is practised in some classes of dress and plush textures from that just alluded to. These fabrics are, in those sections in which several colours run in the same line of the design, two-, three-, and fourfold in structure, according to the number of colours used. In Pattern 2 on Plate XXXIV. a fabric coloured on this principle is given. It is a vesting style of the quilting character, but is illustrative of the common methods of colouring by extra series of warp yarns. On analysis, it is found to be composed of three tints—a white ground, and brown and tan figuring. These are introduced in the warp. Now in such textures there is invariably a ground warp or chain which runs through the fabric, and forms, conjointly with the weft, a firm fabric to which the figuring yarns are secured. This ground warp, usually of one colour, is drawn

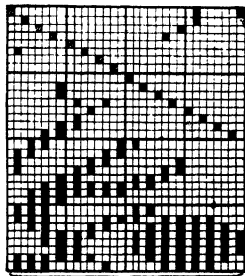
on to a set of shafts, and is worked plain, twill, mat, and other simple crossings. The method of combining the figuring yarns is shown in Figs. 207 and 207A. In the former, the effects are arranged as they are seen in the texture, the blank spaces representing the ground of the fabric, the greys the tan spotting,



Marks = warp.

FIG. 207.

and the solid blacks the brown figuring. Fig. 207A shows how the figuring threads succeed each other in the harness. Between each two threads of figuring there is one ground end. When three or four colours are employed in figuring, there is one ground end for each group of threads. The different series of fancy yarns, working on distinct systems with the weft, have to be run on to separate beams—an arrangement which adds to the cost of manufacture. Moreover, the principle of construction minimizes the weaving capacity of the machine.



First 16 threads of Fig. 207.

FIG. 207A.

If a design, for example, requiring a 192 Jacquard to produce it when developed in one colour, had to be modified to be woven in three colours, each of which formed some part of the figure, it could not be produced in a machine possessing a less capacity than 576 wires. In addition to this machine, the ground of the texture would be obtained by shafts or heddles. The same design, if coloured in the weft, would be weavable in a 192 Jacquard, but would

require 576 cards for developing the figure and 192 cards for producing the ground of the fabric. Hence, while the warp method of colouring is the most economical in respect of cards, weaving, and card stamping, the weft method does not necessitate the employment of a Jacquard of such large figuring capacity.

Amongst the ornamental styles of woven goods coloured in the warp that may be analyzed, are cotton quiltings, velvets, and various classes of pile fabrics.

226. *Cotton Quilting Fabrics*.—Quiltings being one of the most interesting and important of warp-coloured figured textures, may be primarily examined.

In texture and ornament, they constitute a specific type of woven fabrics. One essential in which they differ from other textures of a vesting character consists in the figure or ornamentation being produced by several colours, or rather series, of warp threads. Belonging to that class of fabrics figured by the warp and not by the weft yarns, the designs are arranged to elevate or depress any particular set of threads, according to the section of the pattern being formed. The threads which constitute the ground of the texture, compose what is termed the ground warp, while other series of yarns are "extras." A similar arrangement of warps is employed in some classes of plush, tapestry, and carpet weaving, but in no fabric is an identical effect obtained to that which characterizes this kind of vesting.

The warps which produce the figured pattern in quiltings do not flush or float loosely on the surface, but are regularly secured to the foundation texture, making a "fast" figure, that is, a pattern which, though marked and well pronounced, is even on the surface and firm in construction.

Generally, quiltings have a light or white groundwork, which is neatly ornamented with small lozenge, diaper, or other figured effects. The plan of the design (No. 2, Plate XXXIV.) is geometrical, yet there is an absence, due to the floral details, of that rigid appearance which is frequently associated with patterns constructed on this base. Weave, or the system of interlacing adopted, is the factor which imparts a variety of tone and effect to the style. The texture is woven in three.



A B C D

1



2



Plate XXXIV  
EXTRA-WARP COLOURING

1. Stripe Design
2. Quilling Texture



colours—brown, tan, and white. The floral and sprig combinations are formed of the first colour, the raised or diamond portions of white, and the indentions of tan. The quantity of white or tan in any particular part of the fabric is due to the structure of the design employed. The groundwork of the fabric is neat and effective. It consists of a fine texture of white, slightly raised above the indented border surrounding the figures. The small diamond effects are produced by the lifting of the figuring warp, which imparts an indented appearance to the cloth. On this groundwork, two rectangular objects are placed in such a way that the inverted figures they contain oppose each other. Treating of the rectangular objects first, they are separated by the diamond groundwork, and also by the narrow border of dotted effect, in which, in the fabric, the tan colour is the most prominent. The space between this edging and the central figures on which the floral and sprig work are delineated, consists of rib or rep. Here the white and tan are equally balanced. The sprig ornamentation is characteristic of this style of vestings. It has not been produced, nor can it be applied with such facility, to other types of woven fabrics. The fineness of the texture, and smallness of the threads employed, make it possible to develop the most minute figuring quite distinctly. A neat and interesting contrast is obtained by having the sprig effect in one figure faintly marked, while in the other the floral work is both bolder in form and more compact in arrangement.

227. *Ornamental Characteristics of Quilting Designs.*—The ornament applied to this make of fabric is so unique that it deserves to be briefly noted. It is typical of the texture in which it is developed, being, so to speak, part of its construction. No other build of fabric admits of the production of such fine, line-like, and detailed figured effects as are obtainable by this principle of weaving. The most minute decoration is here delineated with a precision that it would be difficult to surpass with the pencil. All the figures employed are graceful and delicate in appearance, due mainly to the absence of floats of warp or weft from their composition. Elaborate designs, crowded with combinations of form, are thus produced by a neat,

tasteful method. Some patterns which would appear coarse, in other makes of fabric, possess in these textures clearness, combined with an effective arrangement. The examples supplied in Pattern 2 on Plate XXXIV., and Pattern 1, Plate XXXV., are illustrations of the minute character of the ornamental forms developed in these fabrics. Whatever the class of figuring practised, it is full of small twig and floral effects and clear and precise details.

228. *Attributes of Plush Fabrics.*—Another description of woven production coloured in the warp is plushes, including imitation astrakhans, the figured velvet, and several classes of carpets, for example, Eastern, tufted, and Axminster. The distinguishing quality of all plush fabrics is the soft shag or pile with which they are so covered that one of the essential features of a woven texture—namely, the crossing of warp and weft threads—is entirely concealed. The pile is of two kinds: in some fabrics it consists of a uniform mass of cut short filaments, while in others it is in the form of minute curls or loops compactly clustered together; but in both cases, it projects from the surface of an ordinary texture. The fineness of the fibre and density of the plush both combine to conceal the foundation on which it is produced. The characteristic appearance of velvet, as well as its quality of softness, which distinguishes it from all other loom products, are due to the pile alone. The beauty of the fabric is dependent upon the compactness and uniform evenness of the pile, any inequality in the length of the fibres of which it is composed producing an irregular and defective appearance in the texture. In plush weaving, one series of threads forms a species of curl or loop on the ground of the fabric; or such threads, after having been secured to the foundation of the texture, are cut into short filaments, causing them to be erect on the surface of the texture: hence a plush or velvet fabric is an ordinary texture overspread with a compact, dense pile.

229. *Origin of Velvet Weaving.*—Velvets are said to have been originally produced in Asia. The Chinese claim to have been the makers of a fabric of this description at a comparatively early date. Velvet manufacture, for a considerable period after



its introduction into Europe, was confined to Italy, where, in the weaving establishments of Venice, Milan, Florence, and Genoa, it was extensively carried on with marked success. Two Genoese manufacturers, Etienne Turqueti and Barthélemy Narri, under the patronage of Francis I., in 1536, are reported to have commenced velvet weaving in Lyons, at which place it has down to the present day remained an important industry. The productions of the French looms speedily surpassed those of Italy, both in fineness of texture and in soft, lustrous appearance. Rather more than a century after velvet manufacture had been established in France, it was introduced into England by the refugees of that nation when compelled, by the Revocation of the Edict of Nantes, in 1685, to leave their country, who, coming over to England, settled in Spitalfields, the ancient seat of the English silk industry, and there domesticated this important textile art.

230. *Velvets, Compound in Structure.*—All velvets are what may be termed compound in construction—that is to say, one series of threads is appropriated to the production of the *ground* of the texture, while a second series is employed in the formation of the *pile*; in other words, there are distinct warps or wefts necessary to produce the plush and foundation of the fabric respectively. As to the ground, it may be formed of the plain make or of a fine twill. The threads used in the production of the pile may be of various colours, and treated in such a manner as to yield a slag or plush of several lengths. When the pile is obtained in the warp it may be either cut or uncut; that is, the plush may be formed of small, curl-like loops, or of merely the ends of threads projecting from the body of the cloth. In figured plushes, the various parts of the pattern are developed by resorting to these two modes of producing effects, some sections of the pile being cut, and others remaining uncut, while to further enhance the character of the design an ottoman rib effect may also ornament specific portions of the fabric.

231. *Two Classes of Plush Fabrics.*—Technically, plushes are divisible into two great classes: (1) Weft plushes, or fabrics in which the pile is formed of flushes of extra weft yarns distinct from those producing the ground of the fabric. (2) Warp plushes,

or fabrics in which the pile results from the use of extra warp yarns distinct from and independent of the warp utilized in forming the foundation of the texture proper.

The richest effects are producible on the latter principle, which is probably the original method of plush weaving. Weft plushes comprise, however, a considerable variety of textures, including velveteens, corded velveteens, corduroys, astrakhans, and feather trimmings.

232. *Warp Plushes*.—In the first place, let it be understood that for whatever purpose the fabric is intended, at least two warps are essential in its production. Though wound on to separate beams and subjected to different tensions, yet they are so combined by the weft yarn, that they both, when amalgamated, become important factors in the same texture. The weave used in the construction of a warp plush is essentially of a two-fold character, consisting of a ground crossing, and of a flush arrangement for producing the pile effect. Plain, mat, rib, and twill weaves are applied to the ground, according to the fineness and characteristics of the required texture. As to the pile, it may be either cut or uncut, of one or several colours, and also of such variable lengths as are requisite to the development of the forms contained in the pattern. Whatever the character of the plush, it is due to the employment of wires which are inserted between the threads of the pile warp. Thus the wires are introduced when the series of threads in the ground warp is depressed, and such threads elevated in the pile warp as are in accordance with the formation of the design. In some velvets the whole of the pile warp is lifted for the insertion of each wire. Fig. 208 illustrates the system on which the wires are employed, as well as the manner in which they produce the pile. Only nine warp threads, six picks of weft, and three wires are represented. The threads lettered *A* form the pile, and those lettered *G* the ground warp. In this diagram the wires are shown entering the warp when threads *G* are depressed and threads *A* elevated.

233. *Methods of securing the Pile*.—Fastening the pile is an important feature of the weaving process. Unless a sufficient number of ground picks is inserted between the wires, and un-

less they form such interlacings with the pile warp as to secure the threads it contains to the ground of the texture, whether the plush is looped or cut, it will draw out, and the result will be a defective fabric. A point, therefore, that should have careful attention is that of securing the pile in such a manner that it will remain erect after the withdrawal of the wires. The usual method of effecting this consists in arranging for the ground picks to float over the pile threads, both immediately before and after the insertion of the wires, as illustrated in Fig. 208. This plan is adopted, because it has not only a tendency

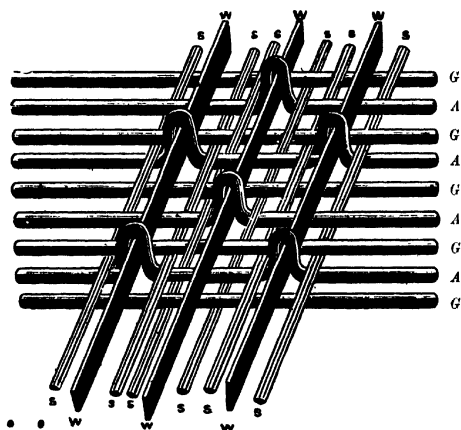
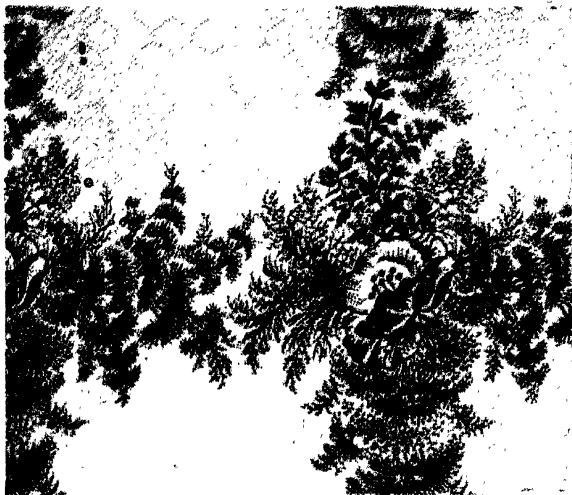


FIG. 208.

to force the wires into position, but to keep them there. It is not, however, the only system; in fact, there are two other useful methods of forming a "bed" or foundation for the wires. One feature of this arrangement is common to all systems, namely, the pile warp is depressed after the insertion of each wire; consequently any difference existing between this and other modes of fastening the plush will be found in the plan of interlacing the picks *preceding* the wire. For example, in making tapestry carpets, the pile warp is not down, but up, in the shed before that formed for the wire; while in a third system, the pile threads float over two ground picks and the wire in succession. Both these systems are better adapted for

the insertion of a large number of wires to the inch of the fabric than the first method described.

234. *Analysis of the Process of Velvet or Warp Plush Weaving.*—The weaver, having interlaced the requisite series of ground shoots between the threads of the combined warps, proceeds to form a division in the threads, by depressing the whole of the ground warp, and in some cases the half of the pile warp, for the admission of the wire. This shed remains formed until the wire has been passed from side to side of the warp and with the grooved edge towards the sley of the going part. On the wire having thus been fixed, the reed is brought against the texture already woven, carrying the wire along with it, which it causes to rest on its lower edge. In this upright position it is maintained by keeping the going part in contact with it, till a new division of the threads (obtained by depressing all the threads covering the wire and elevating a portion of those floating under it) is secured, when the sley or reed is removed from the fell of the cloth and a ground pick introduced to be driven into contact with the ground shoot which preceded the wire. On this principle the wires are bound to the ground of the fabric, for the threads covering them are not only securely woven into the texture by the shoots preceding, but also by those following their insertion. After the proper complement of ground picks has been added, the process of inserting the wires is repeated, several wires always being retained in the fabric. The necessity for this is obvious; thus, if the weaver, before he has introduced a sufficient number of wires, passes his knife within the groove of the first wire, and so cuts the loops covering it, the pile ends would, when tension was put on the warp in the formation of the next shed, draw out, and thus the plush would be destroyed. This is descriptive of the hand method, by which some of the finest decorative silk pile fabrics are produced. In ordinary velvets and carpet weaving, whether Brussels (loop pile) or Axminster (cut pile), the wires are inserted and withdrawn by automatic mechanism. In cut pile carpet weaving, at the end of each wire is a short blade tapering to the end of the wire, so that, when the wire is withdrawn, the threads of pile warp covering its upper edge are cut.



2

Plate XXXV

COLOURING OF FIGURED FABRICS IN THE WARP

1. Old Vastling Style (Quilting)
2. Cut and uncut Pile Pattern



235. *Colouring of Warp Plushes and Figured Velvets.*—Plushes made in imitation of animal skins may be composed of several colours, and also of different lengths of pile. Fig. 209 is a weave for a plush of this order. Threads *B* are grey pile, and threads *T* are white pile. The ground of the texture is formed by threads and picks *G*. The two sets of pile yarns are wound on to separate beams. As the marks in this case indicate threads lifted, it will be noticed that on the first wire only one pile thread is up, namely, *B*<sup>1</sup>, both the white and the ground ends being depressed. The second wire elevates *T*<sup>1</sup>, the third wire *B*<sup>2</sup>, and the fourth wire *T*<sup>2</sup>; so that in each repeat of the design all the pile yarns are up once. This is one method of colouring plush fabrics, and is practised in the production of fancy effects in which no figure or ornamental design is required. When colour is introduced into styles of a figured class for robes and mantlings, it is accomplished on other systems. Pattern 2, Plate XXXV., and Pattern 1, Plate XXXVI., are illustrations of two types of plush or velvet colouring.

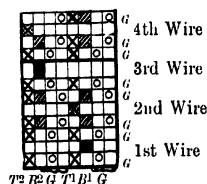


FIG. 209.

Pattern 2 on Plate XXXV. is a velvet pile colouring. Several warps have been employed in its construction, white silk for ground, pale sage green for the principal figure, and variously coloured warps for the minor parts of the pattern. To produce elaborate textiles of this description a complicated form of loom mounting is necessary. First, the ground warp, which is run off a special beam, is passed through a set of shafts hung before the harness and worked by the Jacquard or a dobbie machine. Second, one section of the harness receives the green warp, and other sections the various hues composing the remaining warps. These figuring warps are also mounted on separate beams or run off bobbins or miniature beams, each thread being tensioned separately. The designs have to be so prepared that all the effects which are intended to be of one colour will fall exactly in the same line or occupy the same threads in design.

This is also illustrated in Plate XXXVI., a pattern with silk sateen ground, and with the figuring developed as follows:—

Green leaves and stems in loop and cut pile.

Tinted-rose flowers in loop and cut pile.

Underneath or subdued design in terry or loop pile.

An effective contrast, which is characteristic of pile colouring, is seen in the tone of the cut and loop pile in the green and tinted rose. The difference is so marked as to appear the result of colours of dissimilar qualities. The cut pile imparts a soft, full colour, and the terry, an apparently lighter colour, but of the same hue. This technicality relates specially to pile-fabric colouring. By using the same colour of yarn, *e.g.* green or salmon pink, two tones of green and two tones of pink are acquired. This design element is used in the development of ornamental details; shading in either leaves or flowers being rendered feasible with one colour of yarn.

Another contrast to be noted is that between the sateen ground and the terry pile figuring. The terry is deeper in quality, and, if produced in cut pile, would be still fuller in depth of tone. In construction or loom mounting, the sateen warp would be on one beam, the ground or foundation warp on a second beam, and the pale green, dark green, and salmon-pink warps on bobbins, being individually tensioned, as in Axminster or Brussels carpet weaving.

236. *Brussels and Tapestry Carpets compared.*—Brussels and tapestry carpets are so similar in appearance that they might be regarded as fabrics of the same structure. But, when the principles on which the pattern is obtained in the respective carpets are examined, it is at once evident that in the Brussels the design is purely a woven effect, in the tapestry it is a print. The technical differences between these manufactures being understood, there are causes apparent for the superior wearing qualities of the Brussels. First, in point of colouring it possesses a distinct advantage over the tapestry, for all the shades used in its composition are supposed to be "fast," the yarns being hank dyed and not coloured in the warp. Second, the pile is fuller and made of better materials, while the thickness and substance of the fabric are not due to strengthening threads, like the "body" of the tapestry, but to the worsted yarns used in the formation of the pile. Third, the pattern is more smartly



defined, its various parts being clearly and distinctly developed; whereas the figure in tapestry carpets is more or less indistinct, arising from the system on which the pattern is produced.

237. *How the Pattern is developed in Brussels Carpets.*—The weaving of this carpet possesses some characteristic features. The pile warp, for instance, instead of running off ordinary yarn beams, is wound, as stated, on bobbins, or miniature beams, fixed in frames, or a large creel, placed behind the loom. Each colour requires what is technically called a separate frame. A five-frame Brussels is a carpet with this number of colours succeeding each other in the same line of the fabric. The manner in which the various colours are controlled—in other words, in which they are concealed from, or brought into, view—is an important factor in the manufacture of this article. On examining a Brussels carpet, it will be observed that the individual threads forming the pile seem either to be composed of several colours, or to be substituted by yarns of other shades, according to the section of the pattern being formed. For instance, in the same line of the design, looking at the fabric lengthways, apparently in the same thread, as many as from three to five colours, such as brown, green, fawn, scarlet, and blue, form the pile in succession. If these effects are not due to a printed yarn, they result from the employment of five distinct threads, each of which is so controlled that it only appears in the pile when assisting to develop the design. The question occurs, How are the threads concealed when not appearing on the face of the fabric? An important principle of weaving is implied in the production of results of this character. Whatever the colour of the warp yarn in a single cloth, the pattern is, throughout the piece, continuously tinged with that shade, excepting in such positions as it is crossed with the weft thread. In a double cloth two colours of warp yarns may be applied to one line of the fabric; that is to say, supposing the shades selected were black and white, the pattern produced might be composed of these colours alternately, while in a triple-make fabric three shades could be brought on to the surface of the texture in succession. Effects of this order are due to changing the positions of the threads of the respective warps by reversing the weaves. The several shades of

a Brussels carpet are manipulated on this compound-weave principle of intertexture. To obtain a three-frame pattern composed, say, of green, scarlet, and olive, at least three separate weaves are necessary—one for each shade. Thus the weave used in forming the shed in the warp for the green pile is so arranged as to depress the scarlet and olive, while that for giving the scarlet pile conceals the green and olive threads, and lastly, that for producing the olive pile conceals the green and scarlet ends; so that, by an appropriate application of these respective weaves to the design, the colours are brought up in the figure where required.

238. *Structure of Pile Carpets.*—Fig. 210 is a sketch of the

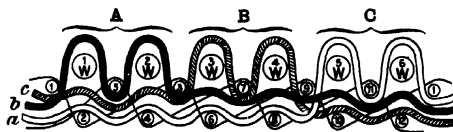


FIG. 210.

interlacing of the threads in a section of this class of carpet, and is a three-frame structure. The positions the threads occupy when not covering the wires, will be evident on examining the illustration. Thus it is clear that when a thread of pile yarn is not active in the formation of the figure, it is covered or concealed by the wire and ground shoots of weft. Take thread *b*, for instance, which, having covered the first two wires shown, floats underneath the succeeding wires; a similar arrangement obtains in the interlacings of thread *c*, which floats under wires 1 and 2, and over wires 3 and 4, while thread *a* is covered by the first four, but flushes over the last two wires; hence each class of pile threads interweaves with the ground weft on the same system, producing a carpet of uniform strength, and one in which every species of pile is equally permanent.

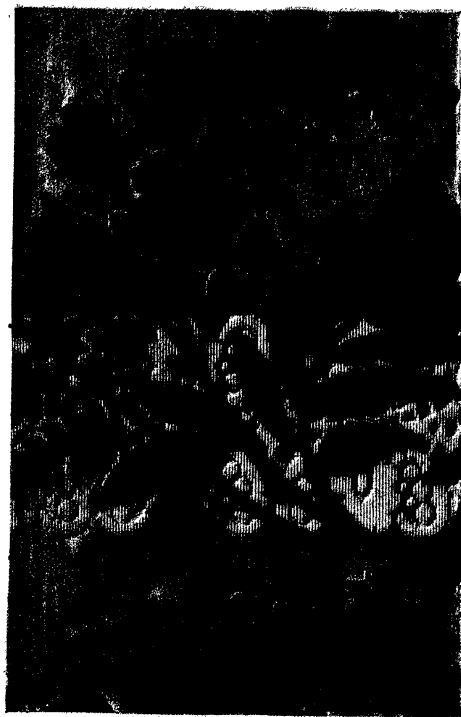


Plate XXXVI

FIGURED PILE SPECIMEN, SATEEN GROUND



## CHAPTER XV

### WEFT-COLOURED FIGURED FABRICS—CURL TEXTURES.

239. Warp and Weft Colouring compared—240. Classes of Designs Coloured in the Weft—241. Designs in which the Pattern is a Product of the Ground Weft—242. Extra-Weft Styles—243. Vestings—244. Vestings with one Extra Weft—245. Two-Cover Vestings—246. Four-Cover Styles—247. Honeycomb Vestings—248. Two-Cover Designing—249. Four-Cover Pine Design—250. Paisley Shawl Colouring—251. Compound-Weft Reversibles—252. Warp and Weft Coloured Figuring—253. Curls, Textiles of the Astrakhan Group—254. Four Types of Curled Effects—255. Curls obtained by Wires—256. Process of Weaving Curls produced by Wires—257. Curls formed by the Weft in which the Warp is Cotton—258. The Weave of Weft Curls—259. Structure of Weft-Curl Fabrics—260. Operation of Cutting after Weaving—261. Curls developed by Milling—262. Points of dissimilarity in the various Builds of Curled Textures—263. Two kinds of Curls developed by Milling—264. Spiral Threads used for Warp—265. Variety of Pattern in Spiral-Warp Curls due to Colour—266. Twist-Yarn Cotton Warp Curls—267. Backed Weaves for Curled Cloths—268. Essential Characteristics of Cotton Warp Curls due to Milling—269. Examples in Designs for Cotton Warp Curls.

239. *Warp and Weft Colouring compared.*—This class of figured styles is the most comprehensive. It includes vestings, robes, ribbons, and an endless diversity of ornamental textures. Richer combinations of tints are more feasible by this than the warp method of colouring. A comparison of these two important systems of introducing colours into figured fabrics, shows that the actual weaving process is less intricate so far as shuttling is concerned—not more than one or two shades of weft being employed—in warp-tinted textiles; but, as explained in Chapter XIV., each additional colour in the same line of the design requires a special warp beam. These arrangements are just reversed in the weft system, for here there may be from two to six shades of weft running in the same line of the fabric, but only one warp is utilized. These conditions make the production

of such fabrics a laborious operation, inasmuch as the number of picks inserted to the inch in four- or five-colour styles may be very large. Thus, in a pattern composed of the latter number of colours throughout, two or more hundred picks to the inch is not uncommon.

Whatever number of shades occur in succession across the pattern it is exactly so many fold in the weft, whereas if the colours are introduced in the warp the texture is several fold lengthways. The different kinds of weft or warp form layers of threads in the woven product. When they are composing the ornamental details of the design they appear on the face of the fabric, but when not thus used they float loosely on the back, only being stitched at intervals, and in patterns of several shades they are frequently not stitched at all. The loose yarns flushing on the under surface of the texture may be cut off. One other detail in the two systems affecting economic production is, that in the weft system, a somewhat inferior or rather less costly yarn may be used than when colouring by the warp scheme. There is a minimum degree of tension put on weft yarns and a maximum degree applied to warp yarns in weaving. In coarse fabrics and cotton textiles this condition does not materially alter the cost of manufacture, but in fine productions it is an item that has to be considered. Summarizing these points of dissimilarity, the warp method of colouring affords the most scope for the development of ornament in pile or plush goods; does not multiply the intricacies of shuttling, but tends to diminish the figuring power of the Jacquard, and requires yarns of a better quality than may be adopted for wefting; on the other hand, the weft method practically allows of more latitude for diversity of colouring and ornamentation of all types of fabrics excepting the plush and leno, and it is, moreover, in fine textiles, less costly, in so far as it makes it feasible to employ an inferior fancy thread with satisfactory results; and lastly, it utilizes the utmost capacity of the Jacquard in the construction of a figured design.

240. *Classes of Designs Coloured in the Weft.*—Fabrics figured and coloured by the weft yarns are of various kinds, but to

facilitate analysis they may be considered under the following distinguishing types:—

- I.—Designs in which the figure is a product of the ground weft.
- II.—Designs requiring one extra weft.
- III.—Designs requiring two extra wefts.
- IV.—Designs requiring three extra wefts.
- V.—Designs requiring four or five extra wefts.
- VI.—Designs composed of two or more wefts and reversible.

As in warp colouring, a ground warp is an essential element of the fabric, in textiles coloured in the weft—Classes I. to V. inclusive—there must also be a ground weft, which forms a suitable texture on which the more elaborate ornamentation due to the fancy shades may be produced. By extras are meant the shades of weft in addition to the ground picks. A design with two extra wefts is called two-cover; with three extras, three-cover, and so on—the ground weft always being added. The word “cover” is therefore synonymous in this sense with “extra,” and has probably been adopted because it partially describes the texture to which it relates, which consists of so many layers or covers of weft threads in thickness.

241. *Designs in which the Pattern is a Product of the Ground Weft.*—In this build of fabric there is comparatively little complication of fabric-structure, of weaving, and of colouring. Thus the weft, which interlaces with the warp to form the ground of the fabric, is also used in the construction of the design. Some types of dress fabrics, particularly those of a lustre character, and mantlings for summer wear, are coloured and ornamented on this principle. It may be regarded as the most elementary type of figured fabric. An example is given in Pattern 1 on Plate XXXVII., which will show the scheme of colouring generally practised in this style of textures. A section of the weave-design is that in Fig. 211. It will be observed that the small figures are composed of solid weft floats, and are arranged on a fine sateen twill groundwork. The warp is composed of lavender cotton, and is mainly useful in constituting the foundation of the fabric, and in concealing the weft picks when they

are not forming the figured effects. The small objects are chintzed with weft colouring, the order of picking being four of dark blue and four of white. This gives the pattern the aspect of a cloth composed of extra wefts. It should be noted that such a contrast in weft colouring, as obtains in this specimen, is only satisfactory in this build of texture when the warp is closely set, and flushes well in the ground sections. If these conditions were not complied with, the pattern produced would be chintzed by the weft in not only the figure, but

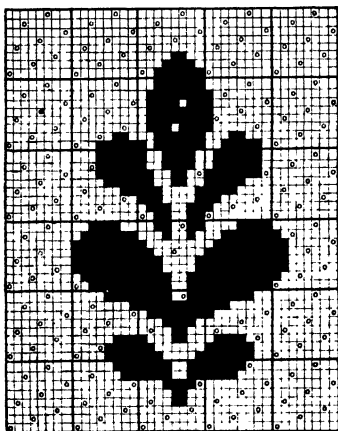


FIG. 211.

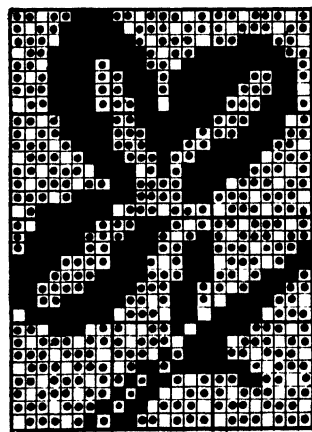


FIG. 212.

also in other parts of the texture. A plain or twill weave, for example, would expose the blue and white shades right across the sample.

Respecting the construction of this style of fabric: it is based on the single-make principle of design. The figure is purely a product of floats of the weft yarn, which are determined by the form of the figure being developed. In some patterns the ornamental sections are composed of twill and other fancy weaves to increase the diversity of effects obtained.

**242. Extra Weft Styles.**—Fabrics of this description are practically two-fold in the weft. An illustration will make the scheme of colouring and design arrangement evident. Pattern 3, Plate XXXVII., is compound in the weft and single in the warps.



for the wefting consists of deep lavender-blue wool, and of white silk, and the warping entirely of lavender cotton. The warp threads are concealed, but this is not an invariable rule, for they may be a different shade from the wefts, and be flushed on the surface of the texture. When this is the case, a buckskin weave is generally used for the ground of the cloth. Should, however, the wefts be worsted and silk, or woollen and silk, and the warp cotton, it is customary to conceal the latter by employing a weave which flushes the ground weft on the face. For vesting and mantling fabrics, this is the common arrangement, but in dresses and cottons, the warp is also used for enhancing the colouring of the fabric. This latter type of design is a compound form of the system illustrated in Fig. 211, two wefts being used instead of one, and each being

utilized in the construction of the figured effects, and also in forming a fine warp twill in the ground of the fabric. Different principles of designing are practised from these, in the construction of such styles as are typified by Pattern 3 of Plate XXXVII. Figs. 212 and 213

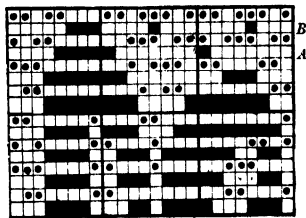


FIG. 213.

are the weave designs to Section A of this pattern. The former illustrates the method of preparing designs of this class on point paper for the loom, and the latter the method by which the two series of picks are amalgamated during weaving. Fig. 213 is the last eight picks of Fig. 212, the ■'s of which form the odd and the □'s the even picks. This is the structure of the fabric; for in stamping the cards each pick of the design as given in Fig. 212 is treated twice: I., the □'s and the □'s are cut; II., the ■'s and □'s are cut. The stitches for the silk or figuring picks are added during stamping, and occupy similar positions in the design to those on picks A and B of Fig. 213. The principle of stitching here corresponds to that of stitching cloths backed with weft—so that the ties are, as far as feasible, introduced in such positions in the picks, that the threads on which they occur are depressed both before and after their insertion. Thus

thread seventeen, on which the tie on pick *A* occurs, is depressed on picks twelve and fourteen—resulting in the concealment of this tie.

Whatever the number of colours used in the construction of this style of figured fabrics, the designs are simply drawn out as in Fig. 212, which shows the relation of the colours to each other in the woven structure.

The manner in which the different effects seen in Pattern 3 of Plate XXXVII. have been produced may be explained by referring to Fig. 213. The first pick of this sectional design—marked in solid squares—is a figure pick, being white in the texture, and corresponding to pick 25 of Fig. 212. The second pick is ground, and also corresponds to the twenty-fifth pick. Now it will be observed that the figuring picks in Fig. 213 float under the threads occupied by the ground picks *succeeding* them; and also that the ground picks float under the threads occupied by the figuring picks *preceding* them. In this way the effects due to the two series of picks—lavender and white, or ground and figure—are kept separate and distinct, and a clear pattern is developed on an equally clear and regular groundwork.

The figured sections here, as in Pattern 1 of the same plate, may be chintzed, as this process does not increase the number of “extras” required. As to the ground of these styles, it is generally a solid colour.

243. *Vestings*.—One of the most important species of woven design to which this scheme of colouring relates is vestings. These fabrics are composed of various materials, and constructed on different principles of design, and may be figured in the warp, weft, or both, but in this example only coloured and figured by the weft yarns. It necessarily follows that the most elementary type of this class of patterns only possesses one extra weft, as the example just considered. This extra colour does not, however, always run through the texture, but merely spots it at intervals. Some of these fabrics are composed of cotton and linen in the ground, with these materials or silk for spotting; others possess a worsted or woollen warp, with worsted or woollen ground weft and silk extras; a third class has a cotton warp, with woollen ground and silk figuring;



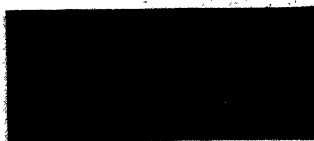
1



2




3



4

Plate XXXVII  
 FIGURED AND SPOTTED FABRICS.  
 WEFT COLOURING  
 1. Chintz  
 2. Extra weft  
 3. 4. Extra weft Spotting



while a fourth class has silk warp and weft for face, and cotton warp and weft for foundation. The first group is mainly produced in light shades for summer wear; the second series has either light or dark grounds; the third series is invariably developed in dark shades, and the fourth in dark and light colours. In the cotton and linen vesting the compound principle of intertexture is utilized; but whatever the weave-construction of the fabric, the scheme of colouring is uniform. Moreover, in the woollen and cotton ground textures, but little diversity of weave is practised in producing the groundwork of these styles; whereas, in the worsted and silk types, various crossings and combinations of weaves are used for this purpose. The construction of the worsted warp vesting affords scope for weave ornamentation in the foundation of the fabric as well as for elaborate figuring by variety of colouring. The two worsted vestings given in No. 2 and No. 4, Plate XXXVII., are, for example, very different from each other in groundwork. The former has a broad diagonal foundation (Fig. 216) composed of several thirteen-shaft weaves; but the latter a fine corkscrew twill in the ground. Fig. 214 also illustrates another system of ornamenting the ground of these textures with weaves. If the spots developed in s were removed, this design would be a rib pattern composed of fine twill and weft cord. With the addition of the spots it forms a neat vesting. In colouring, the rib consists of a distinct shade from either the twilled parts or the spotting. This is obtained by wefting as follows:—

For	{	1 pick of black worsted.
12 picks.	{	1 „ dark blue worsted.
		1 pick of silk.
For	{	1 „ black worsted.
8 picks.	{	1 „ silk.
	{	1 „ dark blue worsted.

This grouping of shades gives a silk spot in the twill parts on a black ground, and a rib effect in dark blue.

In the designing of the ground sections of worsted vestings, it is important to obtain an effect which combines neatness with novelty and richness of colouring.

244. *Vestings with one Extra Weft*.—Only one specimen in this type of vesting is furnished. It is given in Pattern 4 on Plate XXXVII., and, as stated in the previous paragraph, has a corkscrew ground. The weaving plan for this pattern is supplied in Fig. 215. The spots of which it is composed are arranged on the six-end sateen base. The silk picks used in forming the spotted effects are tied regularly, as indicated by the small line marks in the design; hence, in preparing for the loom, the first pick would be stamped twice thus: I., cut all but the marks ☐ and —; II., cut all but the marks ☐.

It will be observed that the spots in the fabric (Pattern 4,

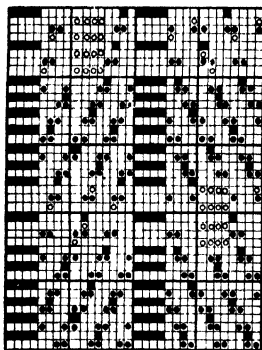


FIG. 214.

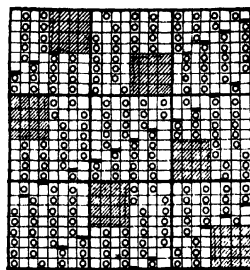


FIG. 215.

Plate XXXVII.) are composed of green, blue, and crimson. This is due to the system of weft colouring practised, which is as appended:—

For	{	1 pick of black worsted.
8 picks.	{	1 „ crimson silk
For	{	1 pick of black worsted.
8 picks.	{	1 „ blue silk.
For	{	1 pick of black worsted.
8 picks.	{	1 „ green silk.

Of course it is feasible to colour a design of this arrangement on other systems. Thus the spots could all be developed in the same colour, or they might each have been composed of two tints, such as crimson and white, claret and lavender, and blue and

olive. The base on which the design is constructed causes the respective spots of blue, green, and crimson in the pattern to be neatly distributed over the corkscrew twill surface forming the groundwork of the fabric.

245. *Two-Cover Vestings*.—Vestings of this class possess one ground weft and two “extras” for figuring.

Loud patterns only being occasionally required in these textures, a scheme of figuring is practised which reduces the cost of production. Thus the spots or figures are only produced here and there in the fabric, a considerable number of ground picks intervening. In this way, the quantity of silk used is considerably diminished. An example may be considered in which two extras are necessary in developing the spotted effects. It is the diagonal pattern given in No. 2 on Plate XXXVII., and referred to in the previous paragraph. The ground design here is composed of four weaves—fine corkscrew, weft sateen, twilled mat, and an upright twill—and, apart from the small figures, occupies 288 picks.

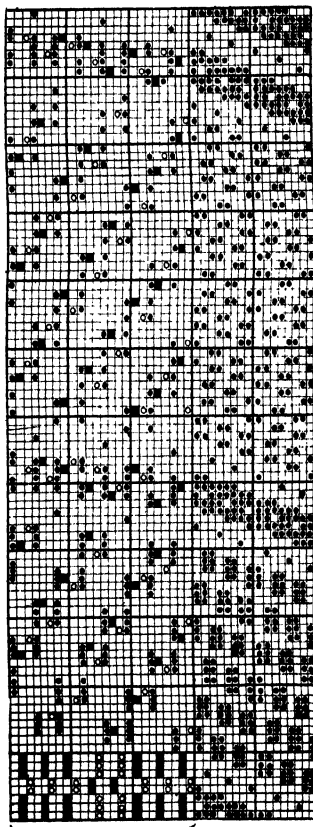


FIG. 216.

The spots are developed in two hues, and are arranged on this diagonal base on a sateen method, six occurring in each repeat of the pattern. Those sections of the design—Fig. 216—in which the spots occur are three-fold in composition, the ground, crimson, and green wefts being combined.

Picks lettered *A*, for example, comprise one spot, and include the ground, crimson, and green picks. The ties for the extra wefts are on the principle indicated. The system of wefting which has been practised in producing the pattern formed of the design worked out on the base of Fig. 216 is as follows:—

For	{	1 pick of black worsted.
24 picks.		1 „ crimson silk.
		1 „ green silk.
		40 picks of black worsted.

Blue and white, orange and blue, and salmon and light-blue, also give neat patterns. Light shades may be, moreover, employed, with satisfactory results, in the ground of the fabric.

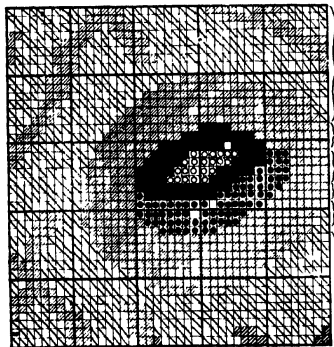


FIG. 217.

#### 246. *Four-Cover Styles.*—

Having considered two specimens of vestings in worsteds, an example in five shades may be examined in woollens. Each shade of weft in figured textiles adds to the construction of this type of design. First, it implies a larger number of cards; and, second,

more picks to the inch, necessitating more weaving. While, however, these complications are the result of the employment of a diversity of colours, yet it is mainly by multiplying the shades of weft that richness of design is obtained. In the example in the four-cover vestings, Design 217, the foundation of the texture is broken crow or weft swansdown. All the effects are due to solid weft floats. The marks  $\square$  represent Shade 1 in the fabric, the  $\boxplus$ 's Shade 2, the  $\boxminus$ 's Shade 3, the  $\blacksquare$ 's Shade 4, and  $\boxtimes$ 's Shade 5. The order of weft colours is:—

For	{	1 pick of Shade 1.
26 picks.		1 „ „ 2.
For	{	1 pick of Shade 1.
12 picks.		1 „ „ 2.
	{	1 „ silk, Shade 3.



For  $\left\{ \begin{array}{l} 1 \text{ pick of Shade 1.} \\ 1 \text{ " " " 2.} \end{array} \right.$   
 • 8 picks.  $\left\{ \begin{array}{l} 1 \text{ " silk, Shade 3.} \\ 1 \text{ " " " 4.} \end{array} \right.$

For  $\left\{ \begin{array}{l} 1 \text{ pick of Shade 1.} \\ 1 \text{ " " " 2.} \end{array} \right.$   
 20 picks.  $\left\{ \begin{array}{l} 1 \text{ " silk, Shade 3.} \\ 1 \text{ " " " 4.} \\ 1 \text{ " " " 5.} \end{array} \right.$

For  $\left\{ \begin{array}{l} 1 \text{ pick of Shade 1.} \\ 1 \text{ " " " 2.} \end{array} \right.$   
 9 picks.  $\left\{ \begin{array}{l} 1 \text{ " silk, Shade 4.} \end{array} \right.$

For  $\left\{ \begin{array}{l} 1 \text{ pick of Shade 1.} \\ 1 \text{ " " " 2.} \end{array} \right.$   
 12 picks.  $\left\{ \begin{array}{l} 1 \text{ " " " 2.} \end{array} \right.$

In preparing the cards, first cut all but  $\boxtimes$ ; second, cut all but  $\boxdot$ ; third, cut all but  $\boxminus$ ; fourth, cut all but  $\blacksquare$ ; and, fifth, cut all but  $\boxplus$ . Picks *A* are stamped twice, picks *B* three times, picks *C* and *E* four times, and picks *D* five times.

247. *Honeycomb Vestings*.<sup>1</sup>—These are an old style of woven textural effect produced in weaves irregular in structure, or in which there is contrast of warp and weft floats, forming diamond, mat, and other effects. The fabrics may be single, backed, or compound in structure. An example of the first type is given in Pattern 1, Plate XXXVIII., the weave being Fig. 218, on a diamond base. The warping and wefting are as follows:—

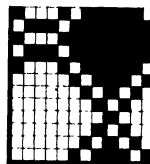


FIG. 218.

2/18* white	.	.	2	21	21	21	19
Double 22's/2 yellow silk	.	.	3	-	-	-	-
2/16* black	.	.	-	3	-	3	-
10's/2 red silk	.	.	-	-	3	-	-

A more irregular type is that seen in Fig. 219, in which the

*Not infrequently with extra colour weft or warp spotting, but the example—Pattern 1, Plate XXXVIII.—is coloured on the ordinary method.*

diamond principle is combined with mat weave, Fig. 220. The method of manufacture is as follows:—

*Warp.*

Three-fold 2/30's white worsted . . . .	—	24
Four-fold 2/36's blue . . . . .	4	8

*Weft.*

Three-fold 2/30's white worsted.



FIG. 219.

It will be seen from both examples that there is much irregularity of weave structure and also in counts of yarn.

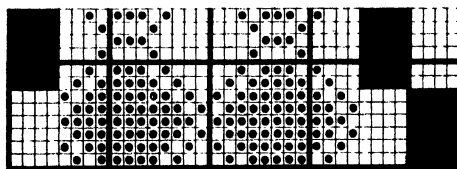


FIG. 220.

248. *Two-Cover Designing.*—Several types of fabrics in addition to Pattern 2, Plate XXXVII., are coloured and figured on this system, which admits of the production of a considerable diversity of effects. Pattern 1 of Plate XXXIX. is an example. The warp of this fabric is cotton, but as the ground weave is a five-end weft sateen, it flushes the worsted picks constituting

the foundation of the texture on the surface, concealing thereby the cotton yarns. A section of the design used in weaving this example is given in Fig. 221. By changing the ground weave to twill, and employing a shade of warp distinct from the weft, the pattern could be improved in colouring. As here tinted, however, it is evident that by this scheme of designing orna-

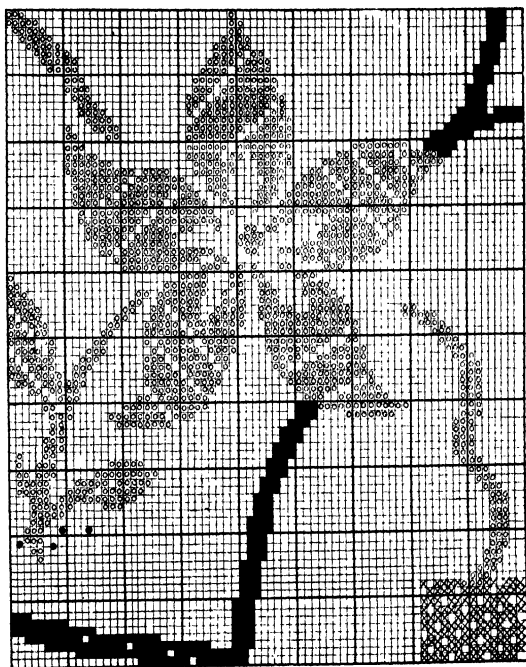


FIG. 221.

mental details may be clearly developed in the texture. The order of wefting is one pick of light fawn, one pick of black silk, and one pick of lavender silk. The texture being two-cover, the process of card stamping is as follows: I., cut blanks, solid blacks, and small circles; II., cut crosses, blanks, and circles; and III., cut crosses, blacks, and blanks.

249. *Four-Cover Pine Design*.—An interesting specimen of four-colour figuring is given in Pattern 2 on Plate XXXVIII.

It is a good combination of colours, textile effects, and principles of weaving. First, as to the blending of tints and the figuring obtained. Though only four colours are used in the weft—claret, lavender or blue grey, olive, and salmon—yet five-tinted effects are produced. The extra tint is due to interweaving the

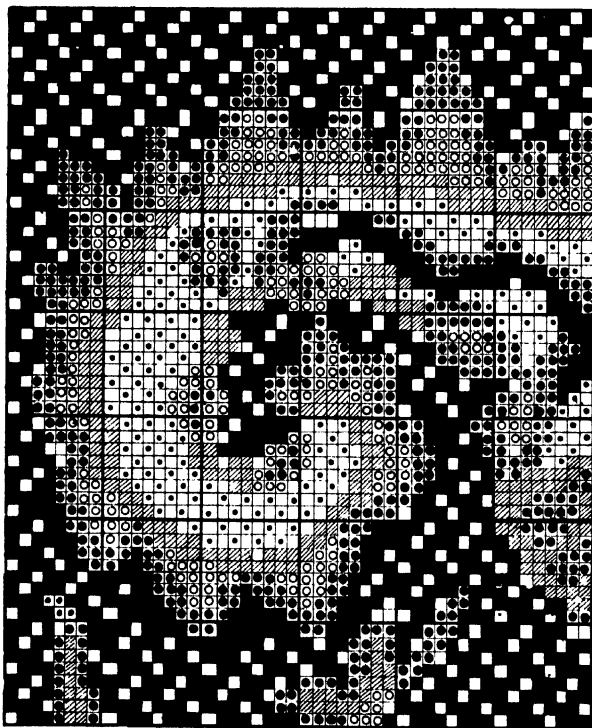
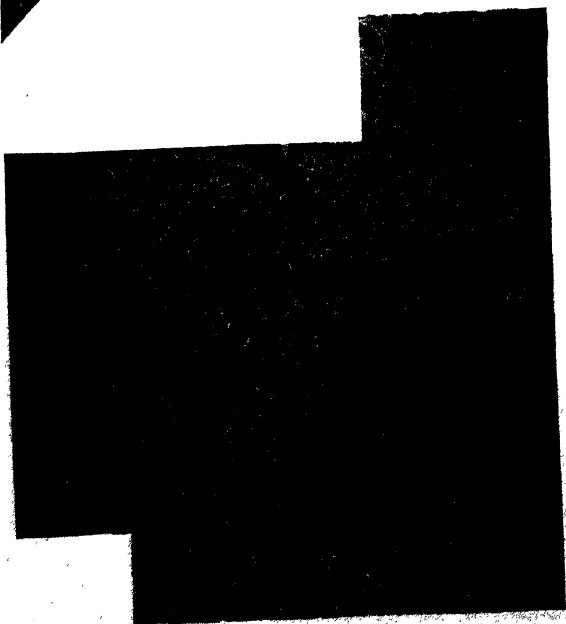


FIG. 222.

warp—which is a bright crimson—plain with the salmon weft, forming that intermingled colouring composing the ground of the interior of the pine figures. The rich claret shade which constitutes the ground of the fabric gives a velvety aspect to the entire pattern, and develops the other tints in the texture.

The order of wefting and colouring is thus: *warp*, all crimson; *weft*, 1 pick of claret, 1 pick of salmon, 1 pick of lavender, and 1 pick of olive. Each shade runs through the fabric, and



2

**Plate XXXVIII**

- 1. HONEYCOMB PATTERN**
- 2. PINE FIGURING**



is continually helpful in imparting tone and character to the whole composition of both ornamental and textural details.

As to the construction of the design. The ground weave—Fig. 222—is a weft broken  $\frac{1}{2}$  twill. All the figured parts of the design, excepting where the warp yarns work plain with the salmon picks, are flushed solid. This is apparent from Fig. 222, which is the weave-design of the upper part of the pine figures. Here the solid squares correspond to the claret in the texture, the dots to the salmon, the circles to the lavender, and the grey marks to the olive. Every pick of the weave-design is stamped four times as follows:—

- I. Cut all marks but solid black.
- II.    "       "       "       dots.
- III.   "       "       "       circles.
- IV.    "       "       "       greys.

The ground weft is tied regularly, but the other wefts are flushed on the under surface of the fabric.

250. *Paisley Shawl Colouring*.—Fig. 223 is on the pine base, similar to No. 2, Plate XXXVIII., but the ornament is of a more elaborate character. The structure of the fabric is seen from the section of a design of this character, Fig. 224, the colours being inserted chiefly in the weft. The weaves in the various parts of the figuring are fine twills running in different directions, and the ground is warp twill. Each kind of mark represents the different colour of weft in which the figuring is developed. Each colour stitches in the weft to make a continuous twill.

251. *Compound-Weft Reversibles*.—Reference should be made, in treating of fabrics coloured in the weft, to rugs and reversible textures, for some classes of shawls, and—in light materials—for mantlings. These textures are composed of weaves which are double or three-fold in the weft but single in the warp. Thus they are of such a character as to allow of the employment of two series of weft threads of different colours. One layer of picks is spread over the other. This will be understood on referring to Fig. 225. The weaves used in the construction

of this 2-ply build of fabric are supplied in Fig. 226. They are simply swansdown twills backed, hence, when combined and woven in a warp composed of small yarns, and with thick weft yarns arranged one pick black and one pick grey, a textile is

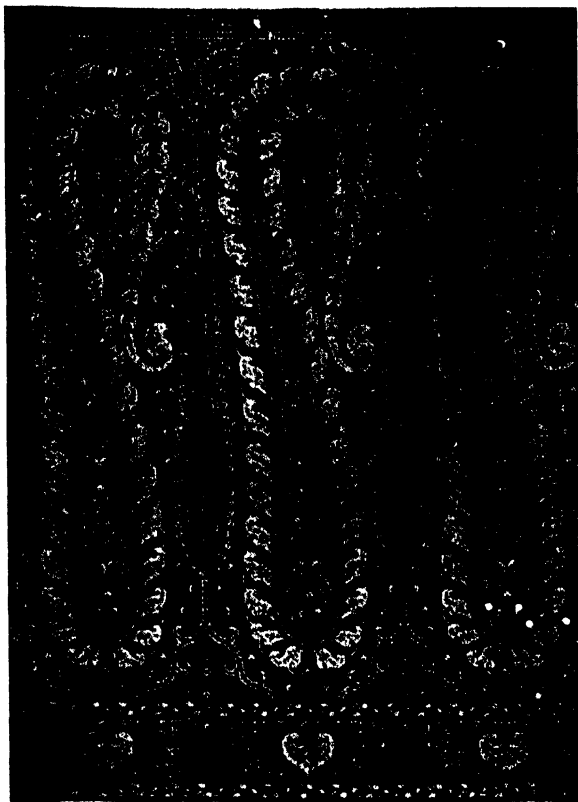


FIG. 223.

produced of the same structure as that represented in Fig. 225. Here it is apparent that the system of weaving causes the black picks to cover the grey picks in part A, and *vice versa* in part B. In the actual texture, the black picks are close together, completely concealing the layer of picks over which they are spread. The same may be remarked of the grey picks in part



*B*; consequently the warp threads, being small, are all but entirely hid, and indeed they should not be observed on either side of the finished fabric.

As the designs are two-fold in the weft, they may contain twice the number of picks to threads per inch, in which case they would be worked out on 8-by-16 point paper. Having determined on

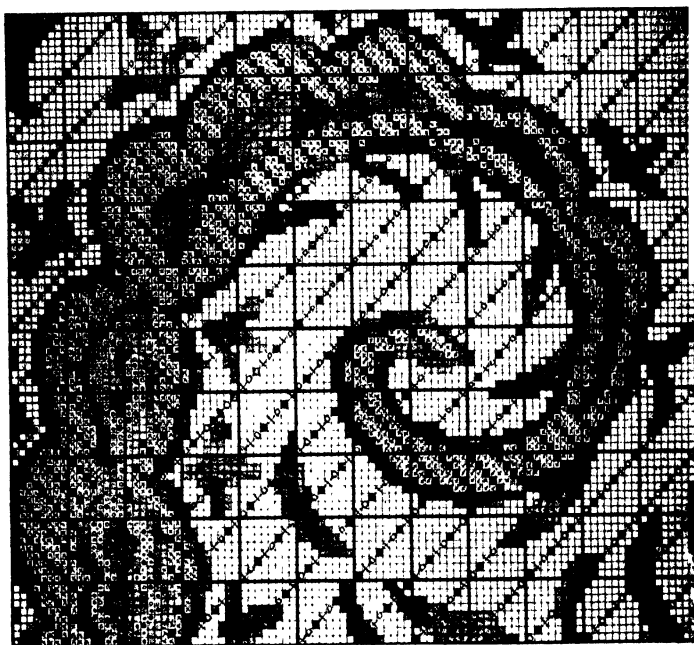


FIG. 224.

the ornamental arrangement of the pattern, say that given in Fig. 227, the sketch is transferred on to the plan paper on the same principle as in designing for double-plain reversibles. Weave *A* of Fig. 226 is then applied to the figured sections, and weave *B* to the ground, and for the hard effect or shade, a weave arranged 2 picks face and 2 picks backing, intermingling the two colours, is also used. Should black and white wefts be employed, the figure on the upper surface would be in black and the ground in white, and the grey portions, Fig. 227, in black and white.

In the 3-ply colouring, Fig. 228, weaves, threefold in structure in the weft, have been used. A simple type of weave for this purpose is given in Fig. 229, where the face and back of the texture are in weft twills, and the centre in plain weave. If a

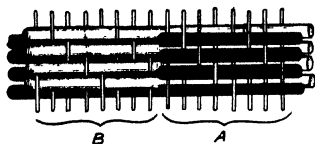


FIG. 225.

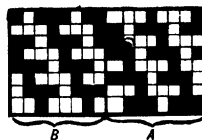


FIG. 226.

finer fabric is required, then six-end sateen with warp prunelle twill in the centre may be used, Fig. 230. By such weaves, three colours of weft may be combined, one for each part of the figuring, and the pattern developed in three shades.

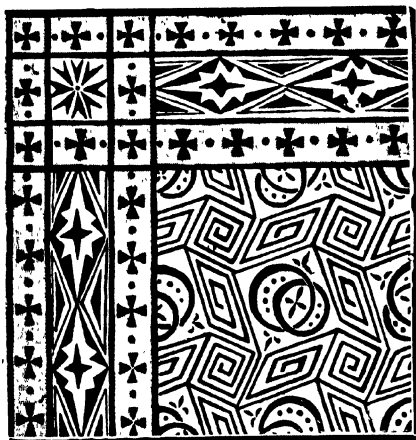


FIG. 227.

252. *Warp and Weft Colouring*.—This species of colouring is principally practised in figured textiles. The ordinary system relates to flushing the warp and weft—which are of different shades—in the construction of the figure, as is instanced in Pattern 3 of Plate XXXIX. Here the outside of the oblong figures consists of floats of weft, and the interior of floats of warp. Now by warping 96 ends of crimson and 96 ends of



FIG. 228.—Three-ply Weft Reversible.

lavender, and weaving 96 picks of tan and 96 picks of white, several tinted effects are obtained. First, a solid square, of lavender is formed; second, square *B* is composed of crimson and lavender; third, square *C* is composed of crimson and tan; and fourth, square *D* is composed of tan and lavender. By this scheme of colouring and weaving, considerable diversity of pattern is producible.

Design 231 is an example in compound warp and weft colouring. The colour of the warp of this fabric would partially form both the ground and the figured effects. Two wefts might be used, say brown and light brown, the former producing the figure and the latter the ground of the texture. The  $\square$ 's represent the rib groundwork, the dots the light brown, and

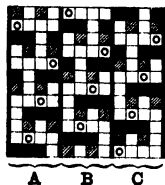


FIG. 229.

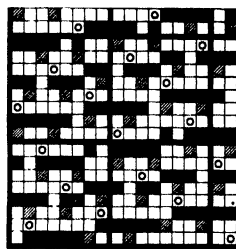


FIG. 230.

the greys the solid floats of warp. Being composed of two wefts, the design is prepared for the loom by first cutting all but  $\square$ 's; and, second, by cutting all but  $\square$ 's. The light brown is regularly tied to the under-side of the texture.

Other types of colouring, having "extras" in both warp and weft, are also practised. They are, however, mainly compounds of the two systems of colouring already illustrated.

A useful example is Pattern 2, Plate XXXIX. The broader floral figuring is developed in warp cord (see sectional design 232). Between such floats of warp making the cord, a firm groundwork is formed. The weft figuring consists of long floats of the light silk yarn, underneath which is also constructed a fast woven texture. The ground weave is a fine cord.

253. *Curls, Textiles of the Astrakhan Group.*—"Curls" are a

type of textile that belong, strictly speaking, to fabrics of the astrakhan and lambskin type. One of the objects here is to

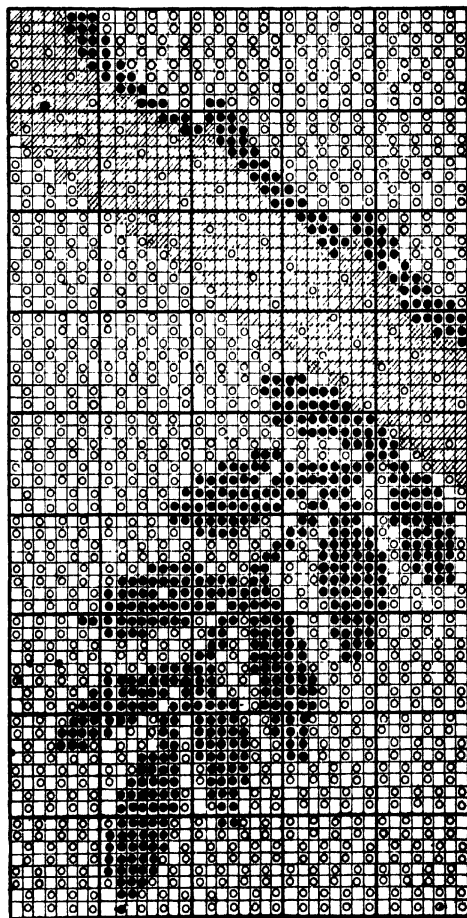


FIG. 231.

manufacture a fabric similar in appearance, texture, and general character to the original astrakhan. But at the same time, it sought to acquire these effects by cheaper and more expeditious methods than are practised in making astrakhan, lambskin, &

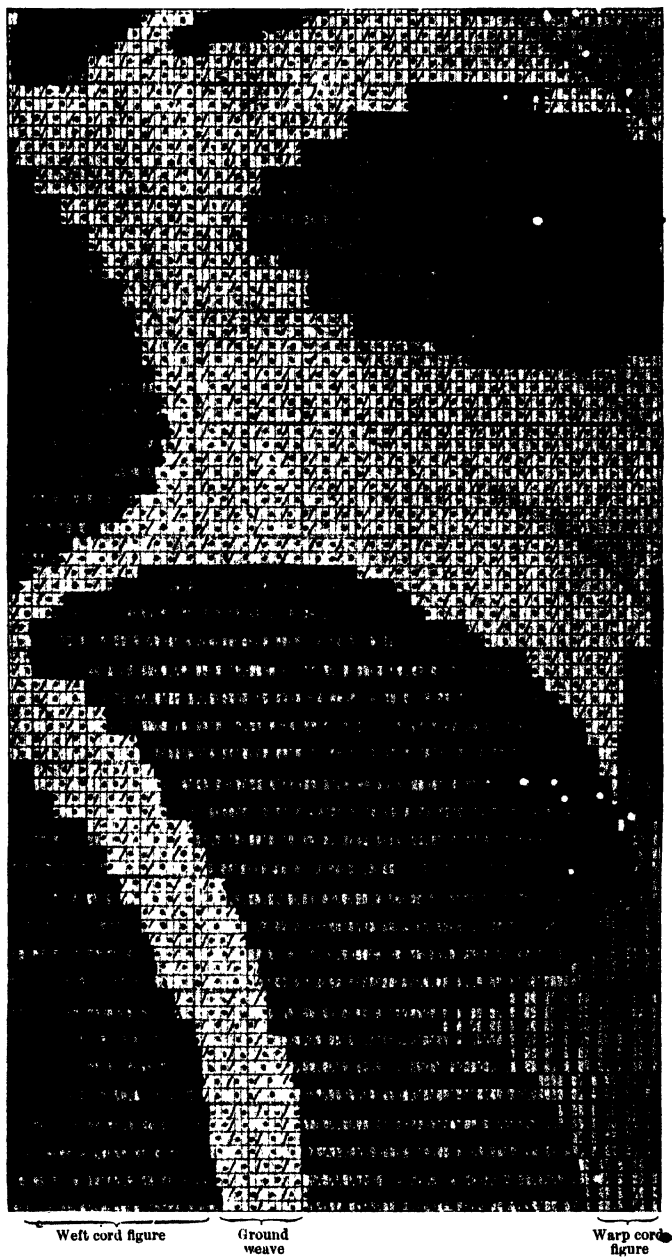


FIG. 282.—Section of Design for Pattern 2. Plate XXXIX.

**SIMILAR FABRICS.** The production of cheap, serviceable "curls" has led to the construction of spiral, curled, and knopped yarns—all threads which, when appropriately employed, impart a curly surface to the cloth.

254. *Four Types of Curled Effects.*—Curled effects may be classified under four heads:—

- (1) Those in which the effect is obtained by employing wires in weaving.
- (2) Those in which the yarn is curled previous to weaving, and the flushes of weft thread cut after the piece leaves the loom.
- (3) Curls due to the employment of yarns composed of two or more classes of materials. The curl in this case is developed in milling.
- (4) Fabrics in which a curled thread is used in the weft.

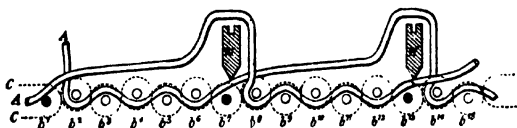


FIG. 233.

The first and second classes of curls represent the original methods of gaining effects of this kind, while the third and fourth classes represent the modern principles of manufacture. Examination of the different classes will show that each possesses some advantages which the other lacks, and also that certain defects are characteristic of each process of production.

In the first species of curls—in which colour is introduced into the warp—are astrakhans, lambskins, and other classes of similar fabrics.

255. *Curls obtained by Wires.*—Curls obtained by the use of wires are fabrics containing two warps—one of which forms the foundation, and the other the curled effect of the texture. The ground warp is usually cotton, the curled warp mohair, and the weft woollen. The mohair yarn is submitted to a process of curling or crimping before weaving, so that when the threads are cut over the wires, in the actual manipulation of the fabric, the ends thus produced twist, twirl, and roll into all kinds of shapes.

The larger the curl, the thicker and more curly the material used in its formation, and the deeper the wires inserted into the cloth during weaving. Fig. 233 will illustrate the principle on which the wires are employed and the part they play in the development of the curly appearance of such fabrics. In this sketch, which is a sectional drawing showing the interlacing of the threads and the position of the wires in a simple astrakhan prior to cutting, threads *A* represent the mohair warp, threads *C* the ground warp, *b* the picks or shoots of weft, and *W* the wires. It will be observed that there are several picks between each wire which interlace with threads *C* to form a texture, or foundation fabric, on to which a layer of curls, closely grouped together, is secured. There is a firm woven cloth in addition to the curled effect in all such structures; and it should be noticed that the more substantial this concealed portion of the foundation, the more durable the texture produced. An insecure ground texture should be prevented in the manufacture of all fabrics in which wires are employed. The picks *b* interweave with threads *C* on the plain principle, but not invariably so, as the three-end twill sometimes forms the plan of intersection for these yarns.

No less than five ground picks are inserted between each wire in the fabric sketched, forming a firm foundation for the wires. Another point secured, by having this number of ground shoots intervening the wires, is the production of a large curl because the wires are not forced into close or absolute contact with each other.

256. *Process of Weaving Curls produced by Wires.*—The routine of the actual operation of weaving this style of curl may be briefly stated:—The proper number of ground picks *b*, having been interlaced with yarns *C*, one half of the mohair warp is elevated and wire 1 inserted; the same number of ground picks is again introduced into the warp *C*, and then the reverse half of the mohair warp raised and wire 2 inserted. This completes the process as far as the interlacing of the threads is concerned. One particular that has not been noticed is the mode of binding the curled warp to the texture; this is effected by depressing the mohair yarns both previous to, and after the



insertion of the wires, crossing them of course with the picks *b*. After some five or six wires have been secured, as shown in the illustration, cutting takes place. This is done by the weaver running his knife down the grooved part of the wire, a process which divides the loops and liberates the threads, when their curling properties cause them to twist and curl so effectually together as to entirely cover the surface of the ground fabric on to which they have thus been fastly woven. The spiral condition into which the ends twist themselves on being liberated, is seen in Figs. 234 and 235, a section of an astrakhan fabric after cutting.

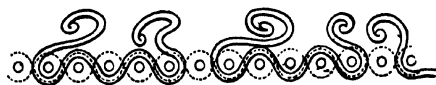


FIG. 234.

A feature in which this class of curls differs from others is that if two or more shades of yarn, and several depths of wires are used, one for each colour of curled warp, then, by a suitable arrangement in the design, an attractive combination of effects results.



FIG. 235.

257. *Curls formed by the Weft in which the Warp is Cotton Threads.*—This class of “curls,” which may be examined in detail, also includes fabrics of the astrakhan group. But here, instead of the curl being obtained in the warp, it is obtained in the weft yarn. In cloths of this order the warp is invariably cotton, while the weft is woollen and mohair—the wool being utilized in the construction of the ground of the texture, and the mohair in the formation of the curly effect.

The system of forming the curl by the warp offers larger scope for variety of pattern and texture, than when it is produced on the weft principle. In this instance, the cloth is

simple in structure. It is possible, however, on this principle of intertexture, to have either a short or long curl. As in warp effects, the mohair yarn has to be curled or crimped prior to weaving by submitting it to a process of boiling, which may be continued for two or three hours, according to the quality of the yarn and the permanence with which it is sought to fix the curl.

258. *The Weave of Weft Curls.*—The weave of this type of fabric is arranged on a simple principle. It first admits of several mohair or flush picks being introduced into the warp, which are followed by a plain ground shoot. If the weave occupies, say twenty-four threads, each flushing pick might float over seventeen ends, and then form a plain interlacing with the remaining seven ends of the series. This process securely fastens the curl picks on to the ground of the fabric.

259. *Structure of Weft-Curl Fabrics.*—Fig. 236 is a section



FIG. 236.

of the interlacing of the warp and weft yarns in this make of textile. Here dots *a* represent the ends of the warp threads; *B*, the mohair weft yarns or flushing picks; and *c*, the plain ground picks. The fabric is twofold in the weft and single in the warp. Picks lettered *B* are placed, in weaving, over the picks or shoots *c*, which produce, along with the ends lettered *a*, a foundation texture on to which shoots *B* may be fastened. The warp threads are thus made to interlace with both kinds of weft, producing, with the cotton or woollen weft *c*, a plain fabric, and, with the mohair picks *B*, a cloth in which the face is formed of long flushes of weft yarn.

Feather trimmings, Fig. 237, are made on this principle, only several widths, *A*, *B*, *C*, of the curl effect are formed in one width of the fabric. The mohair yarn to form the curl is crimped or curled before weaving. The floats in the texture vary in length, and extend from Series *A* to Series *B*, and from *B*

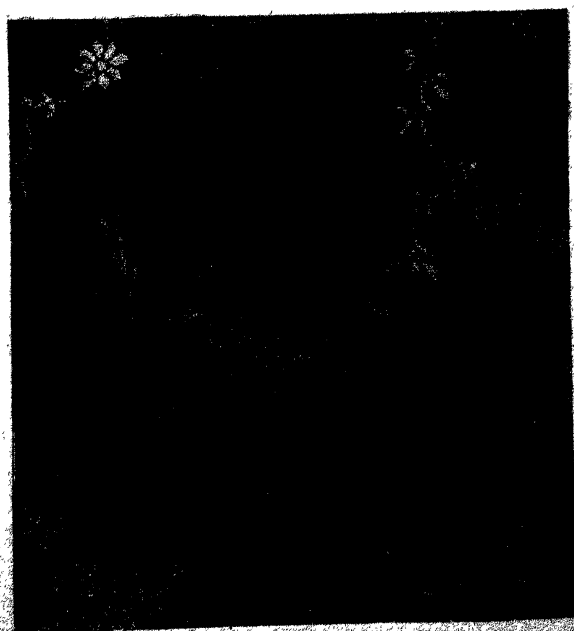
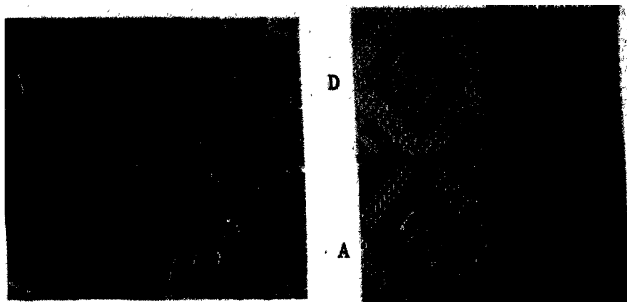


Plate XXXIX

FIGURED STYLES DEVELOPED IN WARP AND WEFT  
COLOURINGS



to *C*. In the illustration, the weft threads floating over such spaces have been severed and allowed to form the curl effect of which the trimming consists. Many methods of colouring are practised in the production of such fabrics, and also, as seen from the specimen *D*, special figuring due to the ordinary type of weaving.

260. *Operation of Cutting after Weaving.*—When the cloth leaves the loom there is no appearance of a curl effect, its under surface being nothing but a plain weave, and the



FIG. 237.

face consisting of long floats of mohair yarn. To produce the curl these flushes require to be severed or cut, when the ends thus obtained twist and twirl into the spiral forms shown in Fig. 235. The cutting process is done as follows:—About two yards of cloth having been stretched tightly on a frame, the cutter inserts the fine point of the knife and guide under one of the row of long flushes formed by picks *B*, Fig. 236; the loops or flushes being arranged in rows, the knife can be made to travel very accurately under each row of loops to the end of the length of texture spread on the frame. As it is forced through this tunnel of loops, it severs the threads, and, as the yarns were curled or crimped

previous to weaving, they immediately assume curly, spiral conditions.

By a slight modification of this principle of weaving it is possible to produce a large variety of patterns. One example of this class of effects is a pattern with a figured design (see *D*, Fig. 237), in which the pine pattern is developed in extra silk weft in addition to the curl effects. Mohair may be the material used for the curled figures and silk for the figuring.

261. *Curls developed by Milling.*—In the two classes of these fabrics already described, the curl effect is the result of preparing the yarn by subjecting it to a crimping process before using it as warp or weft in the composition of the cloths. Both types of curls considered are, moreover, submitted to a cutting operation, which, severing the loops or flushes of mohair yarns, results in the production of the curled characteristic of the textures. In the curled cloths produced in milling, the curl is not due to cutting one series of the yarns in the fabric, but to the more rapid shrinking of some threads in the texture than others, a process which develops loops on the surface of the piece. The curl in this instance is produced by the doubling of certain threads, and not by any curling and cutting operations the yarns may be subjected to either previous to, during, or after weaving.

262. *Points of Dissimilarity in the Various Builds of Curled Textures.*—If a fabric in which the curl is obtained in the warp and by the use of wires is dissected, it will be observed:—On removing, in the first place, to withdraw a curl thread it would be found to be divided into short lengths, each curl being a separate length. The entire series of curls might be removed and still a plain woven texture would remain intact; if, however, either the warp or weft of this foundation structure were disturbed, the whole fabric would be reduced to a group of loose ends.

Let a fabric in which the curl is formed by the weft yarn and developed by cutting, after the piece leaves the loom, be next analyzed. Here it is possible to remove the curls, as in the other fabric, and yet to retain a woven texture. The wide dissimilarity between this fabric and the warp

curl is to be found in the fact that the various short lengths of mohair which form the mass of small curls, covering the texture, are in this case sections of picks of weft and not threads of warp.

Curl textures, which obtain the curly appearance in the milling machine (see Figs. 239, 241, and 243), are constructed on an entirely different principle of manufacture. To remove any thread or pick from this fabric, curl or otherwise, destroys the structure of the cloth. In this type of curl there is only one warp and one weft, the threads of which appear alternately on both sides of the piece. Either warp or weft may contain both woollen and mohair yarns, but still the cloths are constructed from single weaves.

263. *Two kinds of Curls developed by Milling.*—Curled fabrics of this group may be divided into two classes: (1) those in which the curl yarn is introduced into the warp; and (2) those in which it is employed in the weft. The warp thread which forms the curl is in some cases made of the noil resulting from combing mohair or alpaca, or the waste from the machines in making lustre worsted yarns. These materials possess exactly the curling properties that are requisite to the production of the effect characterizing this kind of curl. As to the weft thread, it is made chiefly of "extract" and similar materials.

264. *Spiral Threads used for Warps.*—The warp is composed of twist threads known as "spirals," a name applied to them on account of their crimped form. They derive their principal characteristic from the system on which they are prepared; thus one of the two threads utilized in their production is, during twisting, only slightly tensioned, while the other thread is highly tensioned. This arrangement causes the compound yarn resultant to be crimped or spiral, and to possess an undulated, wavy appearance. When the piece is subjected to heat, soapy moisture, and the friction of the milling process, the thick, slack thread shrinks up into loops, or forms small buttons, or curls, on the surface of the cloth. The process of fulling these cloths is interesting. Previous to this operation the fabric possesses a level surface; for there is little indication in the

cloth when it leaves the loom as to any curly or looped effect. This is entirely a subsequent development. As soon as the felting operation commences, this characteristic appears, the thick and soft threads of the twist yarns forming loops or curls which cover both sides of the fabric.

265. *Variety of Patterns in Spiral-Warp Curls due to Colour.*—Pattern or design in these goods is mainly due to colour combinations. As the weave is generally a four-end twill, there is facility for developing effects of this character with precision and clearness. Styles of a mixture, stripe, and check class are employed. One example of a mixture effect is as follows: Warp, two ends of maroon (spiral) and two ends of green (spiral); weft, all olive brown. The pattern thus obtained is intermingled in colouring, the warp threads giving indefinite and mellow patches of maroon and green, while the weft forms a solid and continued series of olive-brown twills.

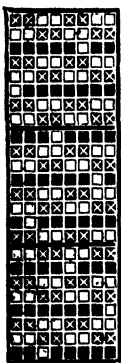


FIG. 238.

266. *Twist-Yarn Cotton-Warp Curl.*—This is a backed fabric, the face or right side being formed of curled twists and the back or under side of woollen yarn. Diversity of pattern or style is, in this kind of curl, obtained by employing several colours or shades of twists. Amongst the twists which are largely used three or four may be mentioned, namely, black and white, black and steel grey, black and olive, and black and medium blue, the white, steel grey, olive, and medium blue forming the loops or curls of the respective threads.

267. *Backed Weave for Curled Cloth.*—A reference to Fig. 238, which is a standard example of the description of crossing employed in making this sort of curls, shows that in reality this curled texture is constructed on the backed weave principle, a system of intertexture which readily allows of the production of a thick cloth. The picks marked in  $\boxtimes$ 's represent the woollen yarns, or weft for the ground, and the picks marked in  $\square$ 's form the weave for the curl effect, or the looped twist weft. On examining the former series of picks, it will be observed that they interlace weft cord with the warp threads. The face weave—



marked in dots—is the eight-heald doeskin or sateen, a plan of crossing which not only permits the curled yarn to be flushed on the right side of the fabric, but attaches it to the woollen and cotton ground texture in a uniform and secure manner. While the curl yarn should not show on the back of the cloth, the woollen yarn should not be visible on the face.

Of course it will be understood that the character of the curly effect is dependent on the kind of twist weft employed; thus, should the yarn be of several colours and the loops on its surface large, a clear, bold curl will result; but should the loops be more of a knop than a curl, the pattern will be correspondingly indistinct.

268. *Essential Characteristics of Cotton-Warp Curls due to Milling.*—The cotton warp, which constitutes the foundation of the fabric, possesses no felting power, but the mohair yarn which forms the weft, though not possessing the same fulling quality as some classes of wools, yet when floated on the surface of a

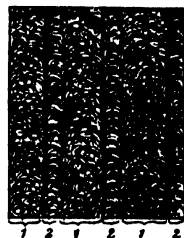


FIG. 239.

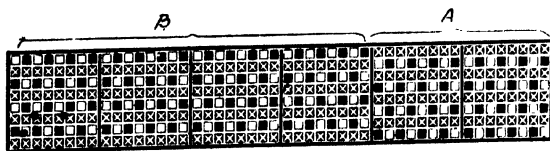


FIG. 240.

cloth of this character, felts to such an extent as to draw, or compress, the warp ends into closer contact with each other; and it is this contracting of the texture in the direction of the weft that produces the curly or looped appearance desired.

It must not be understood that because the curliness is entirely developed in fulling, the structure of the weave in no way affects the pattern obtained, for striped and other effects can be woven by a proper modification in the arrangement of the design. A sketch of a curled stripe made on this principle is supplied in Fig. 239.

269. *Examples in Designs for Cotton-Warp Curls.*—The

weave, Fig. 240, is technically called a plain rib, being so constructed as to flush the curl yarn on the face of the cloth, and yet produce a fast, plain woven texture underneath the floats. All designs for curls of this description are made on the principle illustrated in this weave, and also Fig. 243, it being of equal importance to secure a fast fabric as to float the mohair yarn on the face side of the texture.

Part *A* of the design forms the small curly effects drawn in



FIG. 241.

Section 1 of Fig. 239, while part *B* gives the piping of curls represented in Section 2. When the odd picks—1, 3, 5, and 7—are woven into the warp they flush over the entire series of threads in *A*, but form a plain interlacing with the threads in Section *B*. On the other hand, when the even picks—2, 4, 6, and 8—are introduced into the warp, they flush

over the threads in part *B*, but work plain with the threads in *A*. The woven result of this weave is, first, a striped pattern is formed on the upper side of the cloth, consisting of two distinct bands of curls; second, a firm cloth is produced, though the weft is flushed to such an extent on the upper surface as to conceal the cotton warp, for the picks which give the flushes for the curl in *A*,

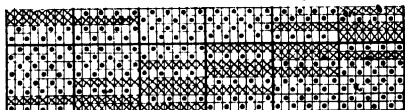


FIG. 242.

form a plain cloth under the picks which float over the threads *B*, while the picks yielding the curly appearance due to Section *B* of the design, at the same time form a plain texture underneath the shoots of weft which pass over threads *A*. So that on this principle, facility is afforded for a proper flushing of the weft yarns on to the upper side of the cloth, yet provision is made in the weave for the construction of an all but plain fabric to which the flushes of mohair that form the curl are securely attached.

Generally these textures are piece-dyed, but in such patterns as those given in Figs. 239, 241, and 243, some excellent styles may be obtained by using two colours of weft yarn, such as black and maroon, blue and olive, and black and white. In such combinations one shade would form the broad and the other the narrow stripe of curls.



FIG. 243.

In Fig. 241 a fabric is sketched in which the curls are distributed, without any apparent design; yet according to the weave—Fig. 242—there is really a twilled or diagonal dis-

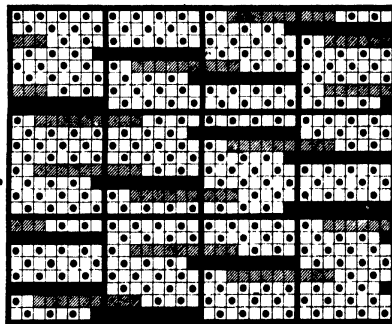


FIG. 244.

tribution of the curls. Felting, however, destroys this characteristic.

A more irregular pattern is that in Fig. 243, produced in Fig. 244, being woven one pick of light, and one pick of dark yarn alternately. In this way, varied colourings and forms of designs are obtainable in these structures.

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